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Medical Service in Campaign

SECOND EDITION

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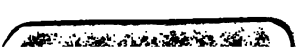

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MEDICAL SERVICE

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Medical Service in Campaign

A Handbook for Medical Officers in the Field

BY

MAJOR PAUL FREDERICK STRAUB
MEDICAL CORPS (GENERAL STAFF) UNITED STATES ARMY

Prepared Under the Direction of the Surgeon-General, United States Army, and Published by Authority of the War Department

SECOND EDITION

ILLUSTRATED

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PREFACE TO SECOND EDITION.

The exhaustion of the first and the demand for a second edition gave an opportunity to revise the book and eliminate errors, and to add new matter suggested by further experience in connection with the instruction in sanitary tactics at the Army War College, and with sanitary units of the troops recently mobilized in Texas. The revised edition was also submitted to the War Department for examination and its publication is again authorized. The plates have been redrawn and several new illustrations have been added. Much care has been taken in the endeavor to make the book conform to existing regulations and orders.

The author desires to express his grateful appreciation of the helpful advice and material assistance given in the revision of this book, by Lieutenant-Colonel D. H. Boughton, General Staff.

P. F. S.

ARMY WAR COLLEGE,
WASHINGTON, D. C.

PREFACE TO FIRST EDITION.

THE following pages include the substance of a series of lectures delivered at the Medical Department, Camp of Instruction at Antietam, Md., in July of 1909.

It seems desirable that some systematic exposition of the subject should be formulated to serve as a ground work for the instruction of medical officers in camps of maneuver, whereby they and the sanitary units in their charge may take an intelligent part in the exercises.

While this little volume is primarily intended for medical officers of the Regular Army and the National Guard, it is hoped that it may be found useful by other officers, especially the students at our service schools who must necessarily give some consideration to the disposition of sanitary troops in all of the larger tactical problems.

PAUL FREDERICK STRAUB.

ARMY WAR COLLEGE,
WASHINGTON, D. C.

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CHAPTER I.

INTRODUCTION.

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Since the Spanish-American War the organization and efficiency of our military establishment have greatly improved by the placing of our service upon a strictly modern basis. Our organization, equipment, and tactical instruction have been adapted to the improved firearms in use, and our Army now compares favorably, except in numbers, with those of the leading military nations.

The creation of a general staff marked a momentous epoch. Our important military problems are now solved by a selected body of officers, and the work of co-ordinating the various arms and departments to make a well-balanced organization is well under way.

These changes have also given foreign military literature a new and increasing interest, and many instructive works on "sanitary tactics" or "service of the medical department in the field" have become doubly valuable since the adoption of the common system of medical aid on the battle-field. The model ambulance system devised by Letterman during the Civil War was, in its day, the most efficient ever organized; and his plan must not be overlooked when this subject is under consideration, although it would hardly suffice in the face of modern arms and advanced ideas of military medicine and sanitation.

The new organization and improved weapons have not, however, so completely revolutionized military methods that the procedures which demonstrated their practical value in earlier days should be lightly thrown aside for new schemes evolved from the inner consciousness of theorists. Everyone who is interested in the service of the Medical Department should

read the medical records of our Civil War, beginning perhaps with the spring campaign of 1864, when the ripe experience of the previous three years was made the basis of a complete and effective organization. Enormous numbers of sick and wounded were taken care of and transported by the Medical Department in incredibly short periods of time without embarrassing the movements of the army, and relieving it of an encumbrance that in the earlier years of the war would have paralyzed the force. Upon the foundation laid at that time has been built our modern system of aid on the battle-field, and it is necessary for a clear understanding of the subject that the scheme developed under the stress and strain of great campaigns should be well studied. The modifications made necessary by new conditions are then easily understood and can be applied without violating the fundamental principles evolved from practical experience.

In the absence of opportunity for learning from actual experience in warfare, one must be content with a theoretical study of the subject, so that all possible preparation may be made for active service. While theoretical knowledge cannot take the place of practical experience, it can at least serve as a foundation for intelligent action when the critical time arrives.

The importance of a theoretical study of military subjects is fully appreciated by our military authorities, as evidenced by the number of service schools now in operation. There are still some who seem disposed to sneer at what they call the "present educational fad" that obtains in our service, and to ridicule many things taught therein because they appear trivial to them, apparently forgetting that the details of the greatest undertaking may be small in themselves, but none the less important in finally determining the success or failure of the enterprise.

The highest function of the physician is to heal the sick, and he who does not respond to the cry of suffering is unworthy of his great calling. It is therefore quite natural that the public, [illegible]me military men, should look upon the medical

officer simply as a practitioner of medicine whose sole mission is to relieve pain and heal the sick, and that the one who is well qualified to do life-saving operations and bring patients afflicted with serious diseases back to health is fully able to do all that is required of a military surgeon. The medical officer who lives up to this limited conception would find himself sadly out of place in active service—indeed, he would be only a civilian torn from his quiet routine and thrust into a sphere of action foreign to his taste and training.

It is true that in time of peace, the reputation, character, and influence of the Medical Department rest almost entirely upon the success attained by medical officers in the treatment of the sick civil and military personnel at army posts. This is so well recognized by the Department that the greatest care is taken to select candidates for commission who are exceptionally well grounded and trained in the duties of the medical profession. The approved candidates are given a year's special instruction at the Army Medical School in the branches that are most useful to medical officers, and when finally accepted into the Corps they have much better opportunities to perfect themselves in their chosen profession than the average civilian physician. Periodical professional examinations of a very searching nature are prescribed in order to make it absolutely necessary for each and every medical officer to devote his time to the study and practice of his profession, if he desires to continue in the service.

In war, however, the utilitarian view of our service must take precedence over the sentimental. Armies are organized and maintained for the purpose of fighting battles and defeating an enemy, and the entire strength and resources of the medical department must also be drawn upon to assist in bringing about a successful issue. It requires but little argument to show that a properly organized and trained medical department can contribute much by its efforts in maintaining the effective strength of an army. This object is not brought about, however, by the successful performance of difficult surgical opera-

tions nor by the treatment of serious diseases, as men who require such skilled treatment are, from the very nature of the cause of their disability, probably lost to the army. In time of war the military value of the medical department depends upon its efficiency in preventing disease through sanitation and early treatment of minor complaints, and relieving an army of its encumbrance of sick and wounded.

Military authorities have at last realized the vital importance of scientific sanitation, and everyone is now fully awake to the fact that stringent sanitary measures have saved many lives, compared to which the loss through bullets seems small. It is impossible to overestimate the influence sanitary conditions have had upon campaigns, and the lessons to be learned from a study of the wars of the past may well command the serious attention of every military student.

With the exception of the very important service of relieving an army of the encumbrance of sick and wounded, ample provision has been made for the education and training of the medical officers of our army in the duties required of them during time of war. The presence of a large number of sick and wounded with a command not only complicates the supply and transportation problem, but also has a very depressing effect upon the mobility of an army. Since much depends upon the latter quality, it is reasonable to believe that an efficient service of the medical department may have a powerful influence in determining a successful result. It has often been remarked by experienced military men that a considerable percentage of sick and wounded with an army in the field, in the absence of a proper evacuation service, would paralyze the force.

In the very conservative foreign armies much attention is given to the training of medical officers and medical department units in preparations for field service. Regular courses of instruction are provided, and all are given frequent opportunities of making practical application of their knowledge at periodical field exercises and maneuvers.

Our foreign confrères have long realized the importance of such studies, as evidenced by the large and constantly increasing number of interesting publications on the subject, many of which contain problems illustrating the general principles underlying the service of the medical department in the field. Some of the problems are based upon actual campaigns and illustrate battle tactics, the influence of time and terrain, and the sequence of important events which are very instructive and give an insight into the subject otherwise only obtainable by actual experience in battle.

Too little attention has been given to this matter in our service, although a decisive step was taken when a medico-military problem was included in the examination of majors for promotion, which serves to call the attention of all medical officers to the necessity of qualifying in the subject.

There is every prospect that the study of "sanitary tactics" or the "service of the medical department in the field" will be made a requirement in the examination of every medical officer. The chief reason for our backwardness in this respect has been the lack of a sufficient number of medical officers to do the strictly professional work in time of peace, and it was not considered practicable to divert the energies of the limited number in service to the preparation for some possible future emergency when the one at hand demanded their entire time and attention.

Of all the subsidiary departments, the medical has been, perhaps, most affected by the change in organization and tactics made necessary by the introduction of modern weapons. Military authorities agree that wars of the future will consist of a series of decisive battles, following in rapid succession one upon the other, and entailing enormous numbers of sick and wounded. Such conditions will make the work of the medical department very arduous and the proper disposition of its organizations a matter of great importance. The longer range and greater penetration of the new rifle bullet have made the problem of the rescue and transportation of wounded from the battle-field much more difficult, although the same

necessity exists, as heretofore, for their speedy shelter and treatment.

There is every reason to believe that very large armies coming into conflict will have a proportionately large percentage of casualties. It is not practicable to maintain a medical department sufficiently large fully to cope with such extraordinary emergencies, for the reason that it is too cumbersome and expensive. It is highly important that the relatively inadequate force should be trained to the highest state of efficiency. This state of efficiency can only be brought about by the requirement that, in addition to professional qualifications, medical officers shall be sufficiently instructed in such purely military subjects as may be necessary to enable them to act in harmony with the troops they are serving.

There is no denying the fact that it is treading on debatable ground to advocate that medical officers should study subjects taught and practised by the line of the army; but it requires little argument to show that a medical officer cannot perform all of his duties efficiently if he does not thoroughly understand the military situation upon which he is expected to base his plan for the relief of the sick and wounded. The sanitary regulations of all armies provide that, in case of emergency, the medical officer shall act upon his own responsibility in matters that pertain to his department; therefore if he expects to perform his duties properly and avoid conflict with the plans and purposes of other troops, he must possess a clear knowledge of the special military situation that confronts him. When such emergencies arise, it is too late to seek counsel and advice from the commander or his staff, as they are probably engaged in more important affairs.

It is by no means necessary that the medical officer should be required to make a profound study of the military art, but he must have sufficient familiarity with it to know how to adapt his dispositions to the tactical situation, to interpret orders, and to formulate his own clearly and concisely, harmonizing them with those of his commander. A working knowledge of map

reading and the properties of ground, a correct estimation of distances, of the danger zone, and of the range of modern firearms would all seem necessary to locate properly the medical department stations.

Before beginning the study of sanitary tactics or attempting the solution of medico-military problems, it is essential to have a thorough understanding of the following subjects:

1. Medical Department regulations and organization in peace and war.

2. Field Service Regulations concerning the Medical Department, rate and length of marches, length of columns, and the capacity and efficiency of the means of transportation for medical supplies and the wounded.

3. Army organization in general, especially as much as concerns the lines of communication.

4. The special conditions and circumstances which attend the service of troops on the march, in camp, and in action.

5. Administrative methods at the various headquarters, and the formulation and interpretation of orders.

6. Map reading and terrain.

Nearly all of the information thus required is to be found in the Army Regulations and the various manuals issued by the War Department, but it requires considerable study to bring the rules and regulations together in such a way as to be able to apply them to a concrete case. An imperfect knowledge thereof would lead only to confusion, and no attempt should be made to solve medico-military problems without the essential preliminary study.

It is presumed that the reader of the following pages is well grounded in the regulations bearing upon the service of the medical officer in the field, and is prepared for a discussion of the method of conducting the service during and after an engagement.

CHAPTER II.

COLLATERAL MILITARY SUBJECTS.

1. Preparation for Field Service.
2. Orders.
3. Map Reading.
4. Weapons.
5. Casualties.
6. Transportation.

CHAPTER II.

PART I.

PREPARATION FOR FIELD SERVICE.

The Field Service Regulations of our Army and, as a matter of fact, of nearly all other services, provide that in cases of emergency medical officers may be authorized to issue orders to their subordinates in the name of their commander. This renders it absolutely essential that medical officers should endeavor to fit themselves for such functions, as the emergencies referred to are liable to arise during the course of any battle, when the time and attention of the commander and his chief of staff are taken up with more pressing duties.

It is quite clear that the administrative medical officer in the field cannot properly perform his full duty unless he is fairly familiar with certain branches of the military art, a knowledge of which is necessary to a clear understanding of the situation to which he is expected to adapt his plans for the succor and care of the sick and wounded. It might be thought that such studies would tend to divert medical officers from their primary function of the care of the sick and wounded, but it requires little argument to show that it immensely facilitates that very purpose. The amount of study required to get a sufficient knowledge of the military topics concerned is but child's play compared with any one of the numerous branches of a medical curriculum, yet the information that can thus be acquired may make all the difference between failure and success of the medical service on the field of battle.

The field training of sanitary troops should proceed on the assumption that they have qualified in all the primary subjects that can be properly taken up in the garrison course of instruc-

tion, and that maneuvers are also instituted for the purpose of illustrating the character and scope of the duties of sanitary troops in war.

After camp sanitation, the most important subjects to be taken up are those pertaining to the care and evacuation of the sick and wounded from the zone of operations. Practice in the selection of locations for stations and evacuation routes is of the greatest importance, but above all, the habit of co-ordination among themselves and with other troops must be inculcated. The sanitary service can only be carried on successfully if complete co-ordination is assured.

Before participating in general maneuvers it is quite necessary that sanitary troops go through a series of independent exercises, for the reason that tactical exercises of line troops are usually carried out so rapidly that untrained sanitary organizations find it very difficult or almost impossible to adapt a complete scheme of battle field aid.

The special medical department camps of instruction afford the best opportunity for such preliminary training, and best prepare officers and men for participation in general maneuvers.

At the large maneuver camps advantage should be taken of the time spent by other troops in battalion and smaller exercises, to carry out a preliminary course of training in preparation for the final maneuvers.

To emphasize the necessity of system and of co-ordination, a definite military situation must be assumed, even if the subject of aid stations alone is taken up. The preliminary exercises must be progressive and lead up to a comprehensive scheme of battle service, including a complete chain of stations and evacuation routes for a brigade or division in action. This would serve to indicate and illustrate not only the purpose and function of the stations themselves, but also their relation and dependence upon one another.

Thus a hypothetical line of battle of a brigade or division occupying a defensive position may be laid out on the ground. The ground selected should not afford ideal cover, but should

illustrate difficulties of the battle service that will ordinarily be encountered. Open and flat ground is unsuitable. It is suggested that a place be chosen that leaves the rear of a part of the line somewhat exposed, but where upon careful study a reasonably safe evacuation route may be found.

The subjects of aid stations, dressing stations, field hospitals, and finally the station for slightly wounded, and the line of communication service are then taken up as follows:

1. A short practical course in map reading and terrain study must precede field exercises with troops, as constant reference to maps is necessary in the solution of problems. By making profiles (page 33) of the country between the enemy's assumed firing points and the proposed site of stations and evacuation routes, the configuration of the intervening ground is shown and the significance of contour lines is made clear. Constant attention to map reading and terrain study must be given throughout the whole course of instruction.

2. **Aid Stations.**—The ground in rear of the brigade or division line of battle is examined with the view of selecting sites for aid stations, not only with reference to the regimental service, but also to the general scheme of the evacuation service to the rear. In the discussion of the suitability of proposed sites, the range of weapons and the efficiency of cover must be taken up. The question of combining aid stations of neighboring regiments also arises. When the stations are finally established, the equipment is demonstrated and the function of the aid station and the character of the surgical assistance to be given is made clear. Hospital Corps men are instructed in their duties and bearer parties are sent out under junior officers to make contact with the regimental battle line, and report upon the best routes of approach.

The places selected are noted on the map for consideration in connection with the exercise in establishing dressing stations.

3. **Dressing Stations.**—The ground in rear of the defensive position is again reconnoitered for the purpose of finding the most suitable locations for dressing stations and evacuation

routes. Proposed stations are carefully examined to determine the character and extent of the cover afforded against rifle and artillery fire, and their accessibility from the front and rear.

When sites have been selected, the routes to aid stations and to the probable location of field hospitals in rear are marked and prepared if necessary. The dressing station is then established, the equipment is demonstrated and the organization, function of the station, and the character of the surgical service to be rendered are discussed. The classification of wounded, the probable number and their further disposition are considered.

The locations and the routes selected will again be noted on the map for use in connection with the succeeding exercise.

4. **Field Hospitals.**—At the next exercise the subject of the location of field hospitals is taken up. The ground further in rear of the line is reconnoitered to find field hospital locations that will best serve the requirements of the front and at the same time facilitate the further evacuation of wounded to the rear. The hospitals are established and their function and relation to the dressing stations and the line of communication service taken up. The organization and character of service to be rendered by field hospitals is also considered.

5. **Station for Slightly Wounded and Line of Communication Service.**—The final exercise includes the selection of a location and the establishment of the station for slightly wounded. Its function and organization are given. The sanitary service on the line of communications is discussed and its relation to the service of the front made clear.

At the conclusion of these exercises the scheme of battle service of a brigade or division may be considered as a whole, including the subjects of supplies and transportation, and the formulation of plans for sanitary service in battle. The subject of "orders" and method of transmission, the elements of tactics in so far as may be necessary to an understanding of battle orders, the different types of engagements and their influence upon the sanitary service, are brought into review.

If time permits, an exercise similar to that suggested above

may be carried out to illustrate the sanitary service of troops acting on the offensive.

Exercises in formulating plans for the sanitary service in battle and on the line of communications are of the greatest value to all medical officers. To assure intelligent co-operation of the entire sanitary force, every medical officer concerned in the execution of the sanitary scheme must have a clear conception of the plans and purposes of higher authority as indicated in orders.

The reconnaissance of the ground necessary for these problems may be made the subject of tactical rides or walks for officers. More time will then be available for the instruction of enlisted men at the regular exercises.

In the following pages some features are given that cannot be classified under the head of sanitation or other professional headings.

CHAPTER II.

PART II.

ORDERS.

Medical officers must not only be able to interpret orders, but to issue them in proper form and in accordance with the instructions laid down in the Field Service Regulations. While there is much on the subject that does not appear to have any special application to medical officers or the medical service, it is still of vital importance that every medical officer should have a clear understanding of all orders and instructions, so that he may adapt and subordinate his directions to the general plans precribed therein.

It would be unwise to attempt to introduce for the medical department a special system of communication with subordinates. Authorized military methods, therefore, must be closely followed, and orders of chief surgeons and other administrative medical officers must of necessity conform to the established custom.

A military order is the expression of the will of a chief conveyed to subordinates. However informally expressed, military orders must be loyally and promptly obeyed.[1]

At the beginning of operations, and from time to time thereafter, the plans of the supreme authority are communicated in the form of *letters of instruction*. These regulate movements over large areas and for considerable periods of time.[2] Similarly chief surgeons of field armies or of armies regulate matters which pertain strictly to their fields of work. Their instructions coupled with sanitary regulations provide a general plan for the care and evacuation of the sick and wounded, renewal of supplies, etc.

[1] F. S. R., 68.
[2] *F. S. R., 70.*

Orders are classified as follows:

1. Routine Orders.
2. Field Orders.

Routine orders are those used in ordinary administration of military affairs, and are called *general orders*, *special orders*, *circulars* and *orders*, according to circumstances.[1]

General orders publish matters of importance to the whole command which are of permanent interest or are to be constantly observed, such as hours of roll calls and duties, police regulations and prohibitions, laws and regulations for the Army, eulogies or censures, and results of trial by general courts-martial.[2]

Special orders are such as concern individuals or relate to matters that need not be known to the whole command.

Circulars publish information and instructions not of sufficient importance to be incorporated in orders. Circulars and memoranda are sometimes rather loosely used in place of orders.

Orders of commanders of smaller units, including field hospitals and ambulance companies, are simply called "orders."

Field orders are those dealing with *tactical* and *strategical* operations incident to a state of war. They do not, ordinarily, include administrative details which are usually better covered by verbal instructions or routine orders.

General and special orders are numbered in separate series, beginning with the calender year, or with the establishment of the organization.

Field orders are numbered serially for each command.

Explanations, apologies, and guesses are signs of weakness in a commander. Interference with subordinates is inadvisable as it tends to relieve them of the responsibilities of their positions. The subordinate, on account of a better knowledge of the local conditions, may often be in a better position to determine the manner of carrying out the details of a plan than higher officers.

[1] F. S. R., Art. III.
[2] A. R., 805.

It is unwise to attempt to make provision in orders for all possible contingencies that might arise during the course of operations.

During active operations the orders of chief surgeons of large commands should ordinarily give general directions only, leaving it to the medical officers directly concerned to work out the details. A certain amount of elasticity must be maintained so that due allowance may be made by those designated to carry the order into effect, for local or peculiar conditions may exist of which higher authority may have no knowledge, and sudden and unexpected changes in the situation may occur at any moment.

Field orders must be *clear* and *definite*. Expressions depending upon the view-point of the observer, such as *right, left, in front of, behind, on this side, beyond*, etc., are avoided, reference being made to the points of the compass instead. The terms *right* and *left*, however, may be applied to individuals or bodies of men, or to the banks of a stream; in the latter case the observer is supposed to be facing down stream. The terms *right flank* and *left flank* are fixed designations. They apply primarily to the right and left of a command when facing the enemy and do not change when the command is retreating.[1] Expressions such as "as far as possible," "as well as you can," should not be used as they tend to divide the responsibility between the chief and his subordinates instead of leaving it where it belongs.

Orders must be brief, and, as a rule, expressed in an affirmative form. An order reading that "the wounded will *not* be evacuated via the SHARPSBURG–BOONESBORO road" is objectionable, because the gist of the order lies in the single word *not*.

It would hardly seem necessary to say that all orders and letters of instruction should be clearly and distinctly written, as they may have to be read under unfavorable conditions of light and weather.

A road is designated by connecting two or more places on

[1] *F. S. R., 76.*

the road with dashes, thus: SHARPSBURG–KEEDYSVILLE–BOONESBORO road, geographical names being written or printed in ROMAN CAPITALS.

To enable the will of the commander to be *quickly understood*, and to secure *prompt co-operation* among his subordinates, field orders are required to follow a general form. Such a form moreover, enables omissions to be more easily detected.

MODEL OF FIELD ORDERS (Attack).[1]

1st Div. 1st Field Army,
Rohrersville, Md.,
2 July, 11, 7 P. M.

Field Orders
No. 12

1. The enemy has taken up a position on the ridge just west of ANTIETAM CREEK, his right in the vicinity of SHARPSBURG. His outposts occupy the high ground all along the right bank of ANTIETAM CREEK, which is fordable at all points.

2. This division will attack and envelop the enemy's right flank to-morrow.

3. (a) The Artillery Brigade, leaving bivouac at 5 A. M., will take position near R. DOMER HOUSE, about 1200 yards north of 444, and at once open fire on the hostile right, supporting the infantry attack.

(b) The infantry, leaving bivouac at 5 A. M., will attack as follows: The 1st Brigade will form under cover to the south of 444 and, with its right resting on the SHARPSBURG–BURNSIDE BRIDGE–444 road, will envelop the enemy's right.

The 2d Brigade will form under cover to the north of 444 and, with its left resting on the SHARPSBURG–BURNSIDE BRIDGE–444 road, connecting with the right of the 1st Brigade will attack the hostile line at SHARPSBURG.

The 3d Brigade will constitute the reserve and follow in rear of the left of the 2d Brigade.

[1] See Antietam Quadrangle, U. S. Geological Survey.

The infantry will advance to the attack when the artillery opens fire.

(c) The Divisional Cavalry (less provost guard) will cross ANTIETAM CREEK to the left of and at the same time as the 1st Brigade, and will cover our left.

(d) The Engineer Battalion will support the artillery.

(e) The Signal Troops will establish and maintain wire communication connecting 444 with the several brigade headquarters, the artillery position, and the trains.

4. The ammunition and supply trains will remain in their present positions.

A station for the slightly wounded will be established at ROHRERSVILLE.

A dressing station will be established at GRUNE HOUSE near SHARMANS BRANCH, about one mile in rear of 444; field hospital at W. SMITH HOUSE on the ROHRERSVILLE ROAD, about 2200 yards in rear of 444.

The remaining ambulance companies and field hospitals will remain in their present positions.

5. Messages will be sent to 444.

By command of Major General A:

B. C.,

Chief of Staff.

Dictated to brigade adjutants, adjutant of cavalry regiment commander of trains and to staff. Copy to headquarters, 1st Field Army.

The caption is the *heading* of the order and consists of the official designation of the command from which the order is issued, and the place, date, and hour of issue, and the number of the order.

The *distribution of troops* (in certain orders) is the marginal notation showing the tactical components into which a command is divided (advance guard, main body, etc.) and the troops assigned to each.

The *body* of the order is divided into numbered paragraphs

without headings. The 1st paragraph contains such information of the enemy and of our supporting troops as is deemed necessary for subordinates to know.

Paragraph 2 gives the general plan of the commander or as much thereof as may be necessary to insure proper co-ordination in the movement of all commands.

Paragraph 3 gives the tactical dispositions adopted by the commander to carry out the purpose indicated in paragraph 2, including the tasks assigned to each of the several combatant fractions of the command.

Paragraph 4 gives the necessary orders for the trains and sanitary troops, and may contain directions as to the disposition to be made of sick and wounded, and the reserve supplies. In battle orders this paragraph may also contain the necessary instructions concerning the establishment of

Stations for slightly wounded,
Dressing stations,
Field hospitals.

In fact, everything applying directly to the service of the medical department on the march or in battle that is deemed of general importance to the whole command, may be included in the order.

Paragraph 5 shows where the commander can be found or messages may be sent. In orders of subordinate commanders, this paragraph also gives the location of "lines of information," if any have been established.

For the use of abbreviations see F. S. R., 90.

Medical Department units may be designated in field orders as follows:

F. Hosp. No. 1.
Amb. Co. No. 1.

Fractions of organizations are designated thus:

Det. Amb. Co. No. 1.
Det. Hosp. Corps, 6th Inf.

The chief surgeon of a division or of an independent smaller command is expected to submit his recommendations concerning the service of the medical department in the form in which its units should operate on the march, in camp or battle as follows:

"The sick of the command will be assembled at ROHRERSVILLE by 5–20 A. M. to-morrow."

"Collecting station for slightly wounded will be established at KEEDYSVILLE."

"A dressing station will be established at GRUNE HOUSE at the junction of the VALLEY and SHARPSBURG roads."

"Empty supply wagons will be placed at the disposition of the chief surgeon for the transportation of the wounded."

However, the *manner* in which these orders are to be executed and the corresponding personnel will ordinarily not be given in the division orders, as such details are of no importance to the command as a whole, but will be communicated in orders to those directly concerned in the execution thereof. The necessary instructions will be given in orders issued by the chief surgeon, under the authority of the commander.

As soon as the chief surgeon of a division receives instructions involving a movement of the sanitary troops, it becomes necessary for him to issue corresponding orders to those troops, so as to secure the most efficient work from the sanitary service. Orders involving the tactical disposition of sanitary troops are just as much field orders as though they related to combatant troops, and should be so classed by the medical officer issuing them.

Excepting the general form of field orders given in the Field Service Regulations, no form has been prescribed for transmitting detailed instructions to sanitary troops. Some form is, however, necessary, and as the form prescribed in the Field Service Regulations is the result of much experience and study, it is evident, from the standpoint of harmony, that sanitary field orders should, so far as practicable, follow that form.

It has already been stated that administrative medical officers cannot intelligently carry out orders unless they have a clear understanding of the military situation that confronts them.

They must have the information concerning the enemy (paragraph 1) that the division commander has seen fit to give out, for they should know at least the general direction from which the enemy's fire may be expected to come. They should know the general plan of the division commander (paragraph 2) in order to make suitable preliminary dispositions of the sanitary units; and they should also know the tactical dispositions to be made of our own combatant forces (paragraph 3) in order to provide for the proper disposition of the sanitary units made necessary by the contemplated movements of the combatant arms. Sanitary troops therefore require practically all of the information that can be gleaned from paragraphs 1, 2, and 3 of the division order. It is therefore advisable for formal sanitary field orders to retain these paragraphs substantially as they are, except the wording of paragraph 3 in the sanitary field order should be in the form of information instead of instructions. This leaves paragraph 4 for the disposition of the sanitary troops and paragraph 5 as the place where messages may be sent.

Acting on these premises, the division chief surgeon's field order, based on the foregoing model division field order, would be as follows:

Office of the Chief Surgeon,
1st Div. 1st Field Army,
Rohrersville, Md.,
2 July, 11, 8 P. M.

Field Orders
No. 4

1. The enemy has taken up a position on the ridge just west of ANTIETAM CREEK, his right in the vicinity of SHARPSBURG. His outposts occupy the high ground all along the right bank of ANTIETAM CREEK, which is fordable at all points.

2. This division will attack and envelop the enemy's right flank to-morrow.

3. Our troops are ordered to move as follows: The Artillery Brigade moves into position near R. DOMER HOUSE.

at 5 A. M., to support the infantry attack. The 1st and 2d Brigades move out at 5 A. M., the 1st forming for attack to the south of 444, with its right resting on the SHARPSBURG—BURNSIDE BRIDGE—444 road, the 2d to the north of 444 and connecting with the 1st Brigade. The 3d Brigade is in reserve and will follow in rear of the left flank of the 2d Brigade. The infantry attack begins as soon as the artillery opens fire.

The Divisional Cavalry is to cross ANTIETAM CREEK to our left at the same time as the 2d Brigade. The Engineers support the artillery. Trains remain in their present positions. Lines of information will connect DivisionHeadquarters, the several brigades, the artillery position, and the trains. Division Headquarters will be at 444.

4. The sick and wounded of this division will be evacuated via the ROHRERSVILLE—CRAMPTON GAP—732—587—MIDDLETOWN road. Hospitals and supply depot have been established at MIDDLETOWN. A transport column will arrive in ROHRERSVILLE at 12, noon, to-morrow. A rest station will be established near BROAD RUN crossing.

Ambulance Co. No. 1 will move out at 5-30 A. M. to-morrow and establish a dressing station at GRUNE HOUSE, near SHARMANS BRANCH, about one mile in rear of 444.

Field Hospital No. 2 will move out at 6-30 A. M. to-morrow and establish at W. SMITH HOUSE on the ROHRERSVILLE road, about 2200 yards in rear of 444.

Capt. X, Med. Corps, and two non-commissioned officers and six privates from Field Hospital No. 4 will establish a station for slightly wounded in ROHRERSVILLE.

The Medical Reserve Supply will remain in ROHRERSVILLE.

Remaining sanitary units will await orders in their present positions.

Messages will reach me at 444.

A. B:
Lt.-Colonel, Medical Corps,
Chief Surgeon.

Dictated to directors of field hospitals, ambulance companies, medical reserve supply, and Capt. X. Copies to division headquarters and chief surgeons of field army and line of communications.

Additional instructions by the chief surgeon to sanitary units, that may have to be given from time to time during the course of the engagement, should also be communicated in the form of field orders. Such supplementary orders need not be as comprehensive, however, as the basic field orders, and will give only such additional information concerning the enemy or our own troops as may be necessary to a clear understanding of the purposes of the instructions, as shown below.

Office of the Chief Surgeon,
1st Div. 1st Field Army,
Near 444,
3 July, 11, 10 A. M.

Field Orders
No. 5

1. Our troops have crossed ANTIETAM CREEK.

2. Ambulance Co. No. 2 will advance via 338—ANTIETAM CREEK to SNAVELY FORD and establish a dressing station near that point, and will serve sector of the line west of that place.

A. B:
Lt.-Colonel, Med. Corps,
Chief Surgeon.

By wire to dir. amb. cos; copies to chief of staff and dir. f. hosp.

Messages in the field are sent on regulation blanks.

The heading "From" is filled in with the name of detachment sending the information, as "Ambulance Company No. 3," "Aid Station, 10th Infantry." Messages sent on the same day are numbered consecutively. The address is written briefly, thus, "Chief Surgeon, 2nd Division," "Commanding Officer Ambulance Company, No. 2." In the signature, the writer's surname only and rank are given.

U. S. ARMY FIELD MESSAGE

No.	Sent by	Time	Received by	Time	Check
25	*Jd.*	*11.15 A. M.*	*Wx.*	*11.18 A. M.*	*10*

This Space for Signal Operators Only

Communicated by
BUZZER, PHONE TELEGRAPH, WIRELESS, LANTERN, HELIO, FLAG, CYCLIST, FOOT MESSENGER, MOUNTED MESSENGER, MOTOR CAR, FLYING MACHINE.
(Underscore means used.)

From *Ambulance Co., No. 2.* NAME OF SENDING DETACHMENT HERE

At *Snavely Ford.* LOCATION OF SENDING DETACHMENT HERE

Date *3 July, 11.* Hour *11 A. M.* No. *2.*

To *Chief Surgeon, 1st Division.*
Near 444.

Dressing station established on west bank of Antietam Creek, fifty yards northeast of Snavely Ford.

E.
Capt. Med. Corps.

Received *11.30 A. M.*

The sender fills in the hour and minute of despatch, and indicates the rate of travel.

"Ordinary" means about 5 miles an hour for a mounted man; "rapid" necessitates trotting 7 to 8 miles per hour; "urgent" demands the highest rate of speed consistent with safety and certainty of arrival at destination.

It is customary to leave the envelope open so that commanders along the line of the messenger's route may read the contents. If it is desirable that the contents be unknown the envelope should be sealed and marked "confidential." The recipient fills in the time of receipt and returns the envelope to the messenger.

The rules adopted to insure clearness and brevity in orders should be followed in writing messages.

A report is a more elaborate communication which gives a complete narrative of some important action or event, and there is not the necessity for brevity and conciseness as in the case of orders and messages.

CHAPTER II.

PART III.

MAP READING.

A knowledge of the rudiments of map reading is of importance to the medical officer in the field and for the solution of theoretical medico-military problems.

Only a few facts and rules are cited, as much of the matter given in books on the subject is important only to those who may be expected to make maps. It must be understood that some practice in the field is required, and the student should take advantage of the opportunities offered during practice marches and other field exercises.

By map reading is meant the ability to grasp the general features of a map and to form a clear conception or mental picture of the ground represented by the map, the corresponding distances on the ground, the network of roads and streams, the heights, slopes and all forms of military cover and obstacles. These are all of importance to the medical officer, especially in the selection of medical department stations and routes for the evacuation of wounded from the battle-field.

The United States Geological Survey map is the standard, but special military maps drawn on a larger scale are sometimes furnished for special field exercises. Three scales are employed in the geological survey maps. The largest is 1:62,500, or very nearly one mile to the inch; that is to say, one linear mile on the ground is represented by one linear inch on the map. An intermediate scale, 1:125,000, or about two miles to one inch, and a third and still smaller scale of 1:250,000, or about four miles to one inch are used. The features shown on these maps may be classed in three groups: *a.* Water, including seas, lakes, ponds and streams, which are shown in *blue.* *b.* Relief; including mountains, hills, valleys and cliffs, shown by contour lines

in *brown*. *c*. Works of man, such as towns, cities, roads, railroads, and boundaries, shown in *black*.

There are four essential points to be observed in reading a map:

1. Conventional signs.
2. Distance.
3. Direction.
4. Contours.

(1) The conventional signs on ordinary maps that are of the greatest interest to medical officers are indicated above and are quite obvious.

(2) Distances are to be determined by the scale shown on every map, although occasionally the scale is indicated by a representative fraction. Thus a "mile to the inch" scale may be characterized by the fraction 1/63360, etc.

(3) On the geological survey maps *North* always corresponds to the top of the sheet, although in other maps it may be indicated by an arrow.

(4) Each brown contour line passes through points which have the same altitude. One who follows a contour on the ground will neither go up hill nor down hill, but always on a level. The contour interval, or vertical distance in feet between one contour and the next is stated at the bottom of the map. Contours enable us to determine the relative heights of different points on the map. They also show the shape of the hillsides, whether concave or convex, and most important of all to us, the cover that might be afforded for aid and dressing stations. Thus an elevation and a depression as indicated by contour lines would appear on the ground as shown in Fig. 1. It will be observed that contours close together indicate sudden rise or fall of ground, and when far apart a more gentle slope.

To make use of a map the observer must first locate his exact position on the map, which may at times be quite difficult. By noting prominent landmarks, towns, streams, the compass bearing of the road or roads, and the contour of the ground, it is usually possible to arrive at a proper conclusion. After the

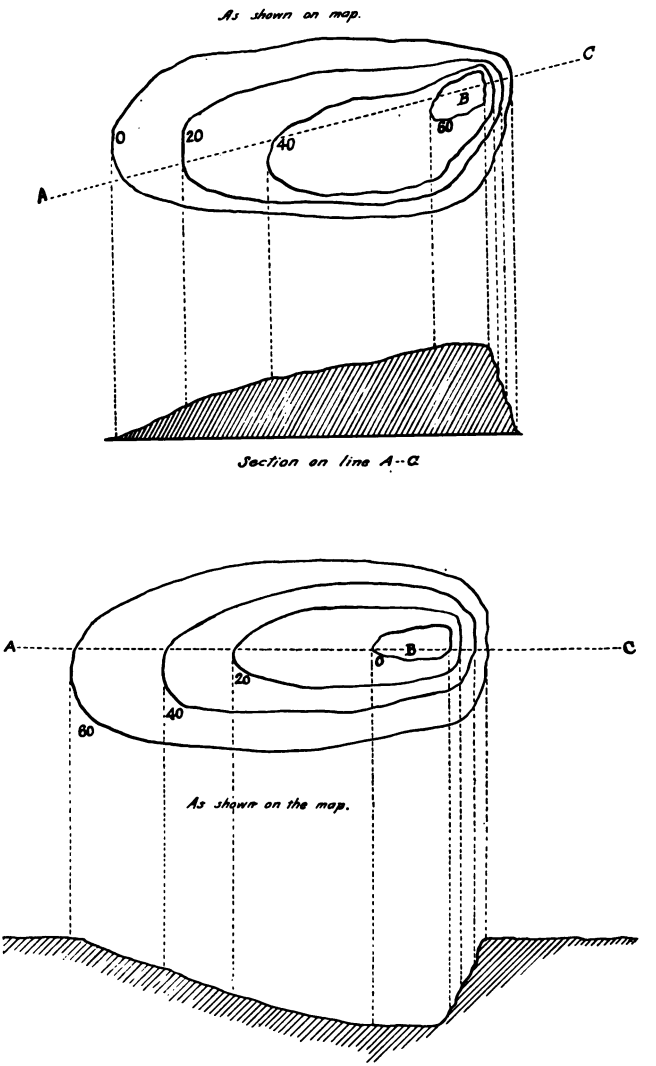

As shown on map.
A
C
0
20
40
60
B
Section on line A--C.
A
C
B
0
20
40
60
As shown on the map.
Section on line A--C.

FIG. 1.

place occupied has been noted on the map, the sheet is to be turned so that the upper edge is to the north (or so that the arrow points in that direction). A compass is an essential instrument in all such exercises, although when the sun is visible the well-known method of determining direction by means of a watch may be used. When a map has thus been oriented, the direction of roads, etc., is at once clear. If, when traveling along a road, the direction, approximate rate of speed, prominent landmarks, cross roads, streams, and the configuration of the ground are noted, no great difficulty in keeping track of the position on the map will be encountered after a little practice. As suggested above, the beginner should take advantage of every opportunity in the field to practise the art of map reading, and the difficulties that he may first encounter will rapidly disappear.

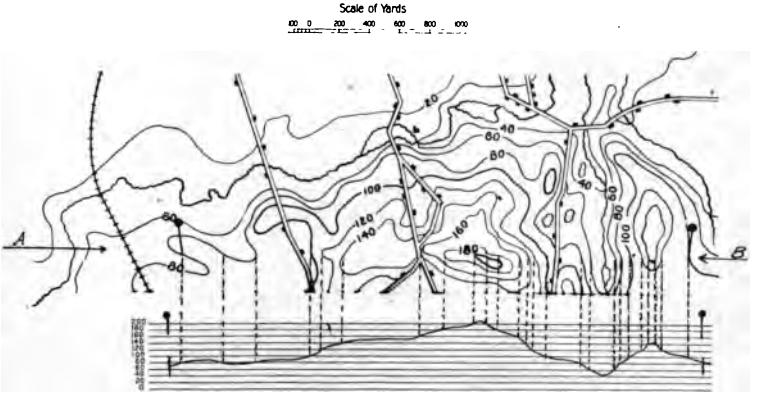


FIG. 2.

In order to appreciate the value and significance of contour lines, it will be found worth while to make a number of profiles of contoured maps, bearing in mind that while the relative elevation of the various points is accurately shown, the slopes are exaggerated. For this purpose profile paper may be used, but for ordinary use parallel lines may be ruled on blank paper.

Figure 2 shows a profile of a line on the map between "A" and "B," and indicates the manner in which it was drawn. The

dotted lines lead from the line to be projected to the corresponding line on the strip of profile paper.

This method is also used to determine if a certain point indicated on the map is visible from a distant position. By laying a straight edge through the two points on the profile, it can be readily seen if there is an intervening obstruction to the view.

Very simple sketches showing locations of aid and dressing stations and evacuation routes may readily be made from a map with a few strokes of a pencil. These sketches can be made to indicate relative positions much more clearly than by written description; can be read quicker and are less liable to be misinterpreted. (Fig. 6.) The back of the "United States Army Field Message" blank (page 28) is ruled in squares for this purpose as shown on page 37.

For convenience of noting the position of established medical department institutions on maps and sketches, the following signs are suggested:

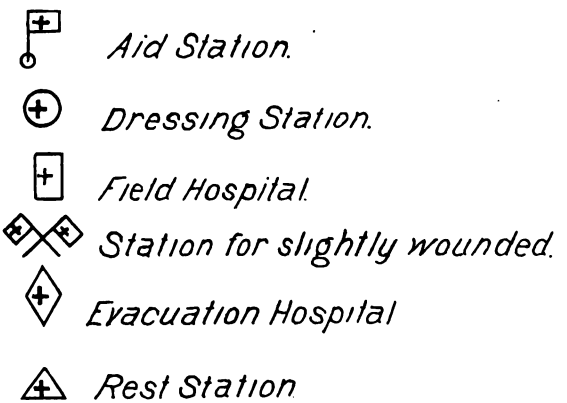


Fig. 3.

The authorized abbreviations that may be used on military maps and sketches, and some of the ordinary conventional signs that are of special significance on military maps are given as follows:

The following abbreviations are authorized for use on field maps and sketches. When these words are used they must be written in full or abbreviated as shown. The abbreviations must not be used for words other than those in the table. Words not in the table are not as a rule abbreviated.

abut.	abutment	P.O.	post Office
B.S	blacksmith shop	Pt	point
bot	bottom	Q.	quarry
Cr.	creek	q.p.	queen post
cul.	culvert	R.	river
cult.	cultivated	R.H.	round house
d.	deep	R.R.	railroad
E.	east	S.	south
f.	fordable	s.	steel
gir.	girder	S.H.	school house
G.M.	grist mill	S.M.	saw mill
i	iron	Sta.	station
I	island	st.	stone
jc.	junction	str	stream
kp.	king-post	tres.	trestle
L.	lake	tr.	truss
Mt	mountain	W.T.	water tank
N	north	W.W	water works
n.f.	not fordable	W	west
p.	pier	wd	wide
pk	plank	w	wood

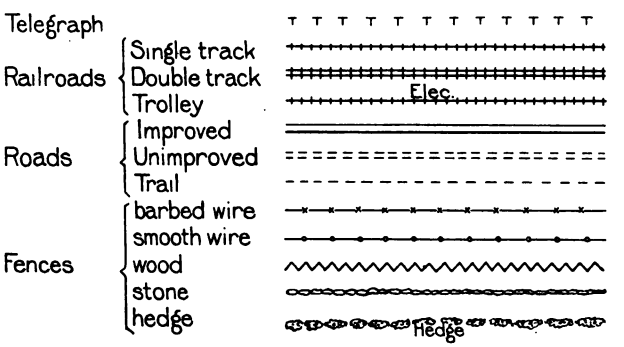
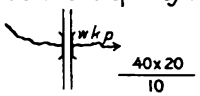


FIG. 4.

Bridge

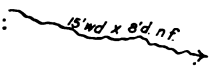
Indicate character and span by abbreviations.

Example: 

Meaning wooden king post bridge, 40 feet long, 20 feet wide, and 10 feet above the water.

Streams

Indicate character by abbreviations.

Example: 

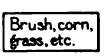
Meaning a stream 15 feet wide, 8 feet deep, and not fordable.

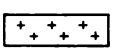
House ▪ Church ± School house =S.H.

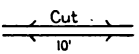
Woods

Orchards Cultivated Land Cult.

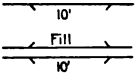
If boundary lines are fences they are indicated as such.

Brush, crops or grass, important as cover or forage 

Cemetery  Trees, isolated

Cut and fill — 

cut 10 feet deep



fill 10 feet high

For more elaborate map work the authorized conventional signs are used

FIG. 5.

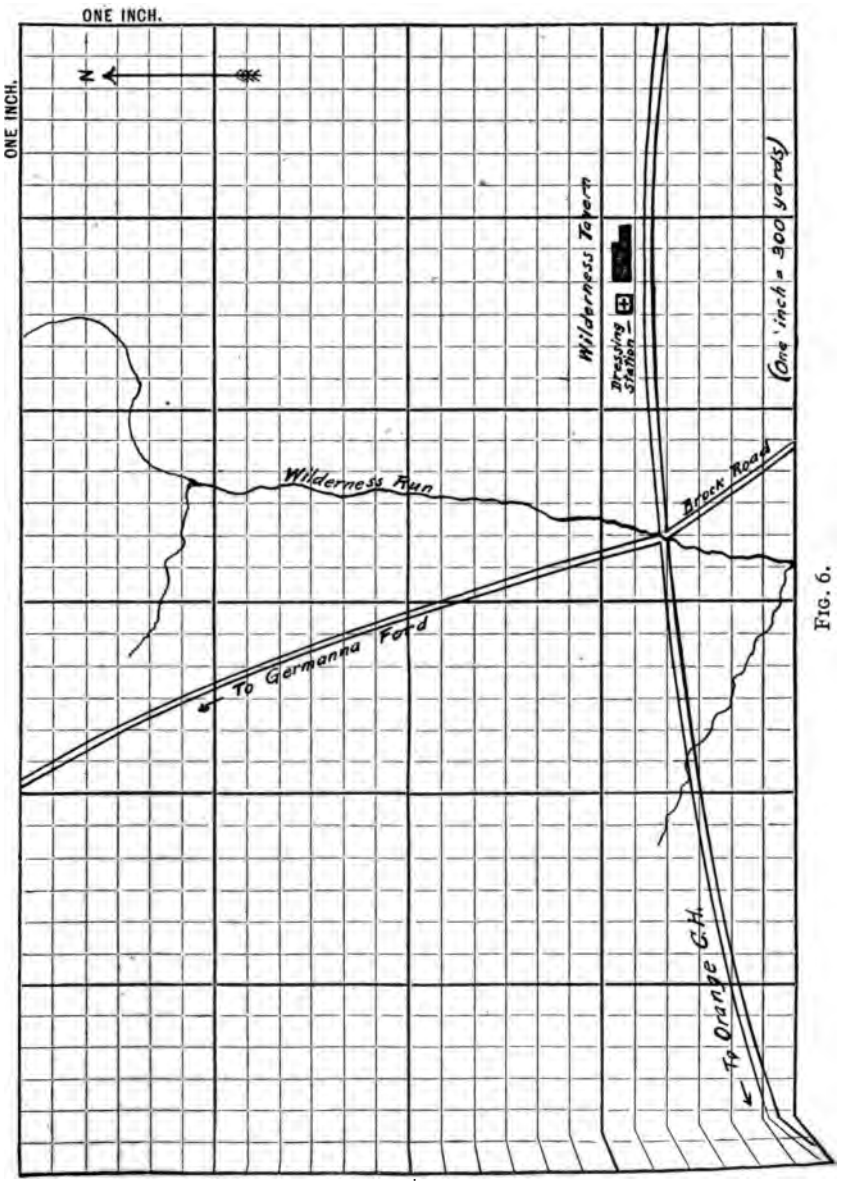

ONE INCH.
ONE INCH.
N
Wilderness Tavern
Dressing Station
(One inch = 300 yards)
Wilderness Run
Brock Road
To Germanna Ford
To Orange C.H.

FIG. 6.

CHAPTER II.

PART IV.

WEAPONS.

The range and efficiency of firearms have an influence upon the medical service in battle that cannot be disregarded. Not only is the character of wounds largely determined thereby, but the dispositions and uses of the medical department units also depend very much upon the trajectory, range, and penetration of the projectiles in use.

Wounds inflicted by modern rifle bullets are, generally speaking, less severe than those produced by the old large-caliber muskets, and with modern surgical methods a much larger proportion of those wounded in action may be expected to return to the ranks. However, the greater range and efficiency of modern weapons makes the rescue and removal of the wounded from the battle-field much more difficult, although the same or even greater necessity now exists for their speedy rescue, in view of the fact that by prompt surgical assistance a very large proportion of those injured in battle may soon be able to resume duty at the front.

As far as the medical department is concerned very little difference exists between the military rifles adopted by various countries, as will be seen from the following table:

Country	Caliber	Sighted up to
United States	.3	2850 yards
Austria	.315	2187 yards
Great Britian	.303	2786 yards
France	.315	2187 yards
Germany	.311	2187 yards
Japan	.256	2187 yards
Russia	.3	2096 yards
Spain	.275	2187 yards

The maximum range of the U. S. magazine rifle is 5465 yards, and the angle of elevation necessary to attain this range is approximately 45°, the time of flight being 31.36 seconds.

The danger space caused by rifle fire is the sum of the distances in the path of the bullet in which an object of given height will be struck.

The point-blank danger space means the distance in the path of the bullet where the ordinates of the trajectory are not higher than 68 inches, which is taken to be the height of the average man.

Point-blank Danger Space.

	Assumed height of line of sight above ground. Inches	Point-blank danger space (computed). Yards
Firing standing	56	718.6
Firing kneeling	30	629.4
Firing lying down	12	589.7

At 1000 yards fire would usually be effective at a line of skirmishers at five yards' interval, and up to 1200 yards on a line of skirmishers at one yard interval.

Fire upon a body of troops at close order of the width of 12 to 15 yards will generally be effective up to 1000 or 1200 yards; upon a body of men with a front of 20 to 25 yards, or upon a section of artillery up to 1200 to 1500 yards, and upon troops in columns of companies or compact bodies of artillery or cavalry at ranges from 1500 to 2000 yards. Beyond 2000 yards, infantry fire will not usually be effective except at very vulnerable targets, such as would be presented by large bodies of troops in mass under conditions which favor bringing the objective within the beaten zone.

We are not, however, so much concerned with the effects of aimed fire, as we do not propose to make our stations a target for the enemy's shots, and it is the badly aimed shots or those fired without aim that interfere most with our arrangements. In severe engagements the aimed shots are comparatively few in number, but the badly aimed, or overshots cover with a rain of projectiles, a deep zone, the extreme limit of which may be taken to be about 3000 yards from the firing point, as shown in

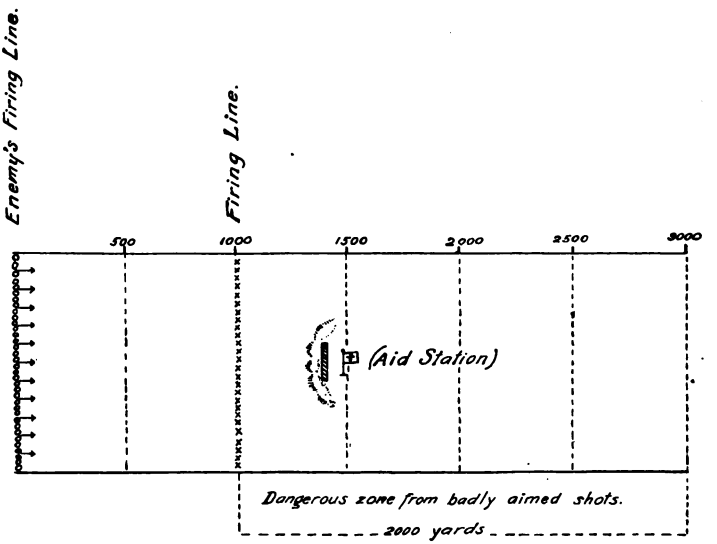


FIG. 7.

Fig. 7. Some bullets will fall beyond and laterally to this zone, but little danger is to be apprehended therefrom. The danger zone does not correspond to the maximum range of the rifle, as it is not probable that any considerable number of men will fire their pieces elevated at an angle of 45° degrees, the angle necessary to attain the maximum range.

The extent of the danger zone from overshots also depends n the height above the ground from which the fire is delivered;

upon the flatness of trajectory, the height of object, the distance from the origin of the fire, and the configuration of the ground upon which it is situated. If the ground where the object is situated is not horizontal, its slope will materially influence the extent of the danger space. If the object is on rising ground, the angle will be increased and the danger space thereof diminished, but if it is on falling ground, the danger zone will be increased as the slope of the ground becomes greater. In studying the trajectory of missiles from modern rifles it would appear that in firing at a crest 1000 yards distant and 30 yards above the firing point, the danger zone from badly aimed shots begins about 300 yards in rear of the crest, if it is assumed that the ground behind it falls to the level of the firing point. In this zone of comparative safety the collection of wounded, and the

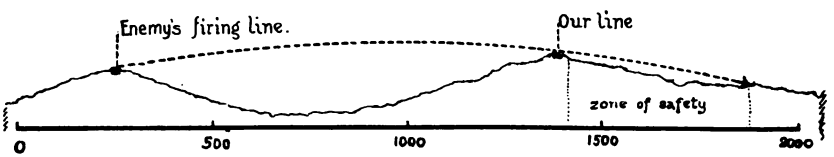


FIG. 8.

application of surgical dressings might go on without great risk during the progress of a battle. (Fig. 8.) Should the difference in height between the firing point and the objective be still greater, the extent of the zone of comparative safety would be correspondingly increased. On the other hand, there would be no zone of safety in the immediate rear of the lower firing point, and nothing could be done in the way of collecting wounded during the progress of the engagement, unless some accident of terrain afforded good cover.

A discussion of the influence of the enemy's fire upon the medical service usually only takes rifle fire into consideration, for the reason that the element of excitement and other disturbing influences do not affect the laying of an artillery piece to the same extent as in the case of aiming with a rifle, and a danger

zone from artillery overshots cannot be spoken of with the same significance. If stations come within the range of exploding shell, it must be considered as a consequence of an ill-advised location, near batteries in action, or on ground that would be ranged over by the enemy's artillery to find concealed batteries.

As far as any influence upon the service of the medical department is concerned, it may be safely assumed that the artillery armament of different armies is practically the same. By giving certain data concerning field guns and howitzers in use in our Army, the present purpose will be adequately served:

Field Artillery.

Gun	Caliber	Extreme range	Weight	Shrapnel		Shell	
				No. of bullets	Size and weight of bullets	Weight	No. of effective fragments
Field gun.....	3 in.	6500	15 lb.	252	.5 in. 167 grains	15 lb.	1200
Mountain howitzer.	3 in.	5800	15 lb.	252	.5 in. 167 grains	15 lb.	1200
Heavy field gun and field howitzer.	4.7 in.	11000	60 lb.	711	.54 in. 230 grains	60 lb.	3000
Heavy field howitzer.	6 in.	6700	120 lb.	1074	.6 in. 306 grains	120 lb.	6000

The area of dispersion for shrapnel as given in the following table is not the *area* covered by a single shrapnel, but includes that due to variations in the points of burst caused by variations in the times of burning of fuses.

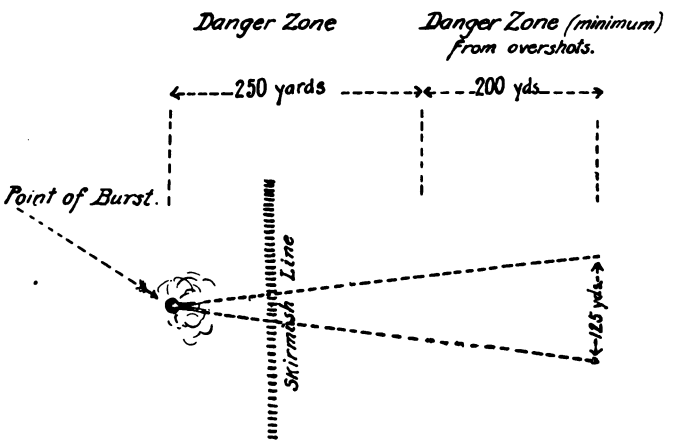
Area of Dispersion.

	Gun	Shrapnel		Shell		
		Length yds.	Width yds.	Length yds.	Width yds.	
At a range less than 3000 yards.	Field gun....	500	150	300	100	Area of dispersion about 100 yards wide and 150 yards long, very effective within a central zone of about 30 yards wide and 20 yards long.
	Mountain howitzer.	400	100	250	75	
At a range over 3000 yards.	Field gun....	400	125	250	75	
	Mountain howitzer.	300	75	150	75	

As indicated above, projectiles used by modern artillery are of two kinds; shrapnel against animate objects—men and horses—and high explosive shell against material targets, such as batteries and defensive works.

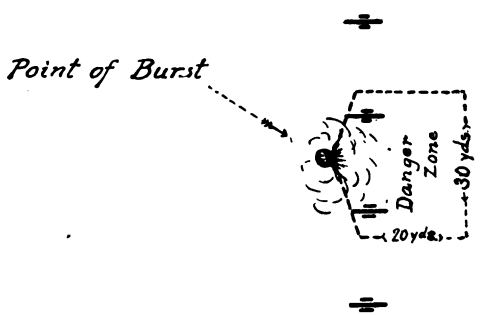
A shrapnel is essentially a thin cylinder or case, closed at the base and filled with round bullets made of lead and some hardening element, such as antimony, which it is designed to carry to a point a short distance in front of the target, there to be expelled with increased velocity over a considerable area. The expulsion takes place through the action of a powder charge placed inside the shrapnel case in the rear of the lead balls. The powder is ignited by the action of a fuse carried in the head of the projectile, so arranged that it can be burst at any desired interval of time after the projectile leaves the gun. Figure 9 indicates the area of dispersion and the danger zone produced by artillery projectiles.

SHRAPNEL.



Area of Dispersion 16° at medium ranges.

HIGH EXPLOSIVE SHELL.



Area of Dispersion 140°.

FIG. 9.

The fuse in the shrapnel is so set as to endeavor to explode it from 80 to 100 yards in front of the target, but owing to variations in the action of fuses, the explosion may be expected to take place somewhere within the space extending from about 150 yards in front to about 50 yards in rear. The danger space that may thus be produced extends therefore from 100 yards in front to about 300 yards in rear of the target.

A shell is a thin-walled steel projectile filled with high explosives, and provided with a sensitive fuse that acts only when the projectile strikes the ground or other obstacle. There is usually an intentional delay so that it will burst only after burying itself in the ground, or when ricochet takes place it will explode a few feet above ground. The first condition is desired when field fortifications are to be demolished, and the second when troops are to be reached that are protected from shrapnel by intrenchments.

Efficiency of Cover against Rifle and Artillery Fire.

Aside from the influence that penetration, range, and trajectory of projectiles have upon the number and character of wounds, they are also of great interest to the medical officer in determining the efficiency of cover against the enemy's fire, for aid and dressings stations.

It must be distinctly understood, however, that the figures concerning trajectory and slope of fall of artillery projectiles have no reference to those fired at high angles from howitzers.

It has also been estimated that 2.5″ of soft and 1.5″ of hard wood, and 15″ of loose earth or sand will stop shrapnel bullets, fired at medium and long ranges and afford effective cover against them.

The effect of high explosive shells is so powerful that ordinary cover, such as light stone walls, ordinary buildings, etc., afford but little protection, and it is hardly worth while to attempt to make an estimate of the probable resistance offered thereto by various materials.

The penetrative power of the new sharp-pointed bullet is given below and indicates the protection that might be afforded by natural or artificial cover.

Material	Penetration inches			
	50 feet	100 yards	500 yards	1000 yards
White-pine butts, made of 1-inch boards placed 1 inch apart.	33.5	46.7	24.3	12.8
Moist sand	8.7	.....	13.4	12.5
Dry sand	4.	.....	9.2	7.5
Loam practically free from sand.	14.	.....	18.8	18.6
Mild steel plate, 0.493 inch thick.	0.446	0.259	.....	.....
Mild steel plate, 0.3843 inch thick.	Through...	Through...	.....	.....
Gun shield steel plate, 0.20 inch thick.	Through...	Through...	.....	.....
Thoroughly seasoned oak, across the grain.	12.2	33.6	.....	.....
Brick wall	.....	5.0	.....	.....

The trajectory and more especially the angle of fall of projectiles as shown in (Figs. 10 and 11) must always be considered when the question of establishing a station within the danger zone from overshots arises. It is easily seen that a site for a station or an evacuation route might be selected, which would be entirely concealed from the enemy's view, but nevertheless as much exposed to his overshots as the obviously exposed high ground in the neighborhood.

As an illustration, let it be supposed that Fig. 12 represents an area of a "two inches to the mile, 20 feet contour interval

map," and that the establishment of an aid or dressing station was contemplated at "A." By measuring the distance between

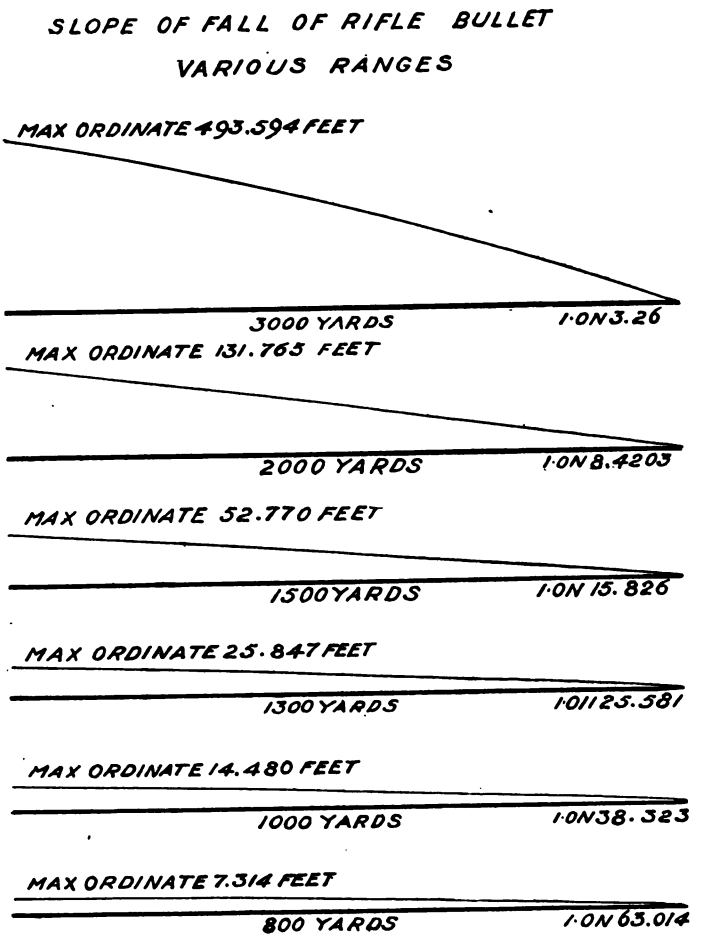


FIG. 10.

the 500 and the 440 feet contour lines, which indicate a fall of 60 feet, it will be found that the slope of fall of a rifle bullet

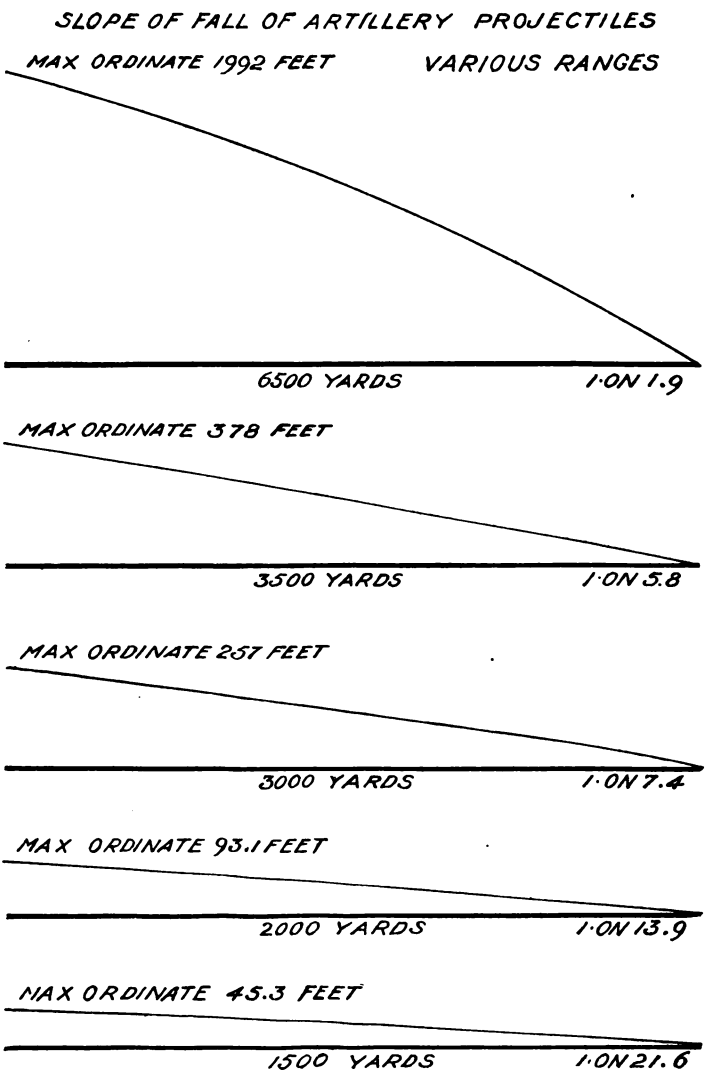
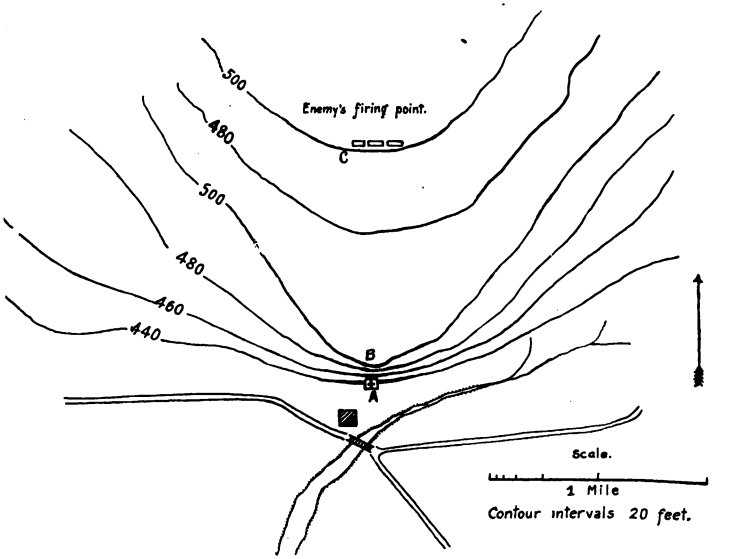

SLOPE OF FALL OF ARTILLERY PROJECTILES
MAX ORDINATE 1992 FEET
VARIOUS RANGES
6500 YARDS
1·ON 1.9
MAX ORDINATE 378 FEET
3500 YARDS
1·ON 5.8
MAX ORDINATE 257 FEET
3000 YARDS
1·ON 7.4
MAX ORDINATE 93.1 FEET
2000 YARDS
1·ON 13.9
MAX ORDINATE 45.3 FEET
1500 YARDS
1·ON 21.6

FIG. 11.

Slope of fall of rifle bullet at 2000 yards range - 1 on 8.4203 feet.



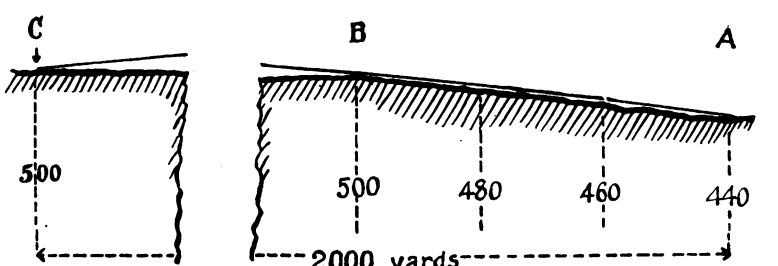


FIG. 12.

fired from a distance of 2000 yards, the position of the enemy's line, corresponds to the slope of the ground, consequently the point "A" would be as much exposed to overshots as the crest at "B." (The distance between the contour lines at "A" and "B" is approximately 500 feet, and the difference between the 500 feet and the 440 feet contour lines being 60 feet, the slope of fall of the ground is about one on eight, which practically represents the slope of fall of a rifle bullet fired at 2000 yards.)

A projection of the contours of a map (page 33) may often be of assistance in determining the efficiency of the cover afforded by the ground, and whether or not a proposed site is visible from the enemy's position.

By reference to the next table it may be determined how large a space would be protected against rifle fire at various ranges by obstacles of certain heights. Such information may be of value when a large dressing station is to be established within the zone of overshots:

Range	Height of obstacle necessary to give cover to a soldier at the following distances in the rear thereof.[1]					
	10 yards	20 yards	50 yards	100 yards	150 yards	200 yards
yards	feet	feet	feet	feet	feet	feet
500	5.8	6.0	6.4	7.0	7.4	7.6
1,000	6.3	7.1	9.2	12.2	14.6	16.6
2,000	9.1	12.6	22.6	38.4	53.1	65.8
3,000	15.6	25.1	50.6	91.7	131.1	167.8

[1] Note.—Assumed that line of sight is horizontal and height of man is 68 inches.

CHAPTER II.

PART V.

CASUALTIES.

Before attempting to describe the system for the relief of the wounded on the battle-field, it would seem to be quite necessary to inquire into the subject of battle casualties, so that some estimate may be made of the losses to be expected, thus giving an idea of the task which may confront the medical department.

The study of battle losses is beset with many difficulties and yields only approximate results, for it must be based upon statistics seldom reliable, and assume factors which are liable to many and unexpected variations. But in no other way can we obtain the information necessary for calculating the probable needs in personnel, supplies and transportation of the department.

Until very recently, the carefully prepared casualty statistics of our Civil War and those of the Franco-Prussian War served as a basis for estimating the losses to be expected in future campaigns, but the introduction of more efficient firearms and the result of the experiences in the Russo-Japanese War may compel some revision of our standards. Unfortunately, the completed statistics of the latter war are not yet available, but enough has been given out to indicate that no radical changes will have to be made in the estimates of losses in future campaigns, and it is therefore believed to be still profitable to review some of the older figures.

The average loss in individual battles was undoubtedly greater in the Russo-Japanese War than in the others mentioned and amounted to 16.7 per cent. for the Russians and 20.4 per cent. for the Japanese, whereas in the campaign of 1870–71 it was only 7 per cent.

Battles	Nation	Strength	Per cent.		Ratio of killed and wounded
			Killed	Wounded	
Shiloh,	Union.....	62682	2.67	13.4	1—4.8
April 6–7, 1862.	Confederate.	40335	4.27	19.8	1—4.6
Antietam,	Union.....	56000	3.749	16.93	1—4.5
Sept. 17, 1862.	Confederate.	40000	6.7	21.93	1—3.2
Gettysburg,	Union.....	88289	3.57	17.5	1—4.6
July 1–3, 1863.	Confederate.	75000	5.2	24.0	1—4.6
Chickamauga,	Union.....	58222	2.8	16.7	1—5.9
Sept. 19–20, 1863.	Confederate.	66366	3.4	22.0	1—6.4
Wilderness,	Union.....	101895	2.2	11.8	1—5.3
May 5–7, 1864.	Confederate.	61025	.....	.....	.....
Spichern,	German.....	28000	2.9	12.7+	1—4.3
Aug. 6, 1870.	French.....	20000	1.6	8.3	1—5.2
Mars-la-Tour,	German.....	66300	4.94	15.5	1—3.1
Aug. 16, 1870.	French.....	126170	1.08	8.0+	1—7.4
Gravelotte,	German.....	146000	3.04	10.37	1—3.8
Aug. 18, 1870.	French	125000	0.9	5.37	1—5.8
Sedan,	German.....	165400	0.989	3.91	1—3.9
Sept. 1, 1870.	French.....	108000	2.76+	12.97	1—4.6
Yalu,	Russian.....	21000	3.0	5.6	1—2
Apr. 30–May 1, 1904	Japanese....	40966	0.5	2.0	1—4
Liaoyang,	Russian.....	140000	1.799	9.85	1—5.5
Aug. 26–Sept. 4, 1904	Japanese....	125000	3.837	14.0+	1—4
Mukden,	Russian.....	310000	2.9	16 3+	1—5.5
Feb. 23–March 10, *1905.*	Japanese....	340000	4.41	17.64	1—4

The percentages given for the Manchurian campaign are for individual battles which lasted for variable periods of time, from a few hours to several days and even weeks.

For the purposes of comparison and as a basis for estimates of medical department requirements for the future, such battle percentages are not entirely satisfactory. It is of some importance that we should know the proportion of losses for each day's fighting, as the wounded are not to be left on the field until the close of an engagement that lasts more than one day. In the Franco-Prussian War most of the 27 battles were fought and decided in one day, and several of the Civil War engagements lasted several days, sometimes more than a week. It has been computed that the percentage of casualties for each fighting day during the campaign of 1870–71 for the Germans was 4.7 per cent., for the Russians in Manchuria 1.7 per cent., and 2 per cent. for the Japanese. The percentage for each battle day of our Civil War was probably not far from that of the Germans.

These figures have not, however, such an important bearing upon the medical service as supposed by some, as there is not the slightest foundation for belief that the casualties were evenly distributed throughout the course of long engagements. Some of the great battles in the Russo-Japanese War were fought over a very large space of ground and continued for many days, but there were always intervals in the course of the battles when troops were not actually engaged.

At Mukden, where the operations extended over a period of nearly two weeks, there were not more than three or four fighting days for any one body of troops. The same state of affairs obtained to some extent in many of the battles of the Civil War. At the battle of Gettysburg, for instance, which lasted three days, the same troops were rarely engaged more than one day.

While there are no numerical data to prove that at critical moments during the Manchurian battles (charges, hand to hand fights, etc.), losses were so high as to equal or even exceed the rate of the average German loss of 4.7 per cent., it is believed,

nevertheless, that such was the case, as several higher units sustained a very high per diem rate. One Japanese division had a daily loss during a period of two days, in infantry alone higher than the Germans average per diem, and in the following two days the loss was four times as great.

Some exceptionally high battle losses were sustained by organizations in the Manchurian War. One Russian army corps lost in a single battle 25 per cent. of its force, and the number of divisions that lost 25 per cent. or over was strikingly great. One Japanese brigade was practically wiped out, as only 10 per cent. escaped. Three Russian infantry regiments lost 57, 61, and 66 per cent., respectively, at Sandepu or Mukden, and four Japanese regiments lost 39, 51, 62 and 68 per cent. in an individual battle. Great losses also occurred on individual battle days, and the record shows that a division lost as much as 30 per cent. and a regiment 46 per cent. in a single day.

The ratio of losses to the average fighting strength of the different arms for the whole war is given as follows:

	Russian	Japanese
Infantry	26.6 per cent.	32 per cent.
Cavalry	9.9 per cent.	2 per cent.
Artillery	8.7 per cent.	14 per cent.

According to Matignon's report, the proportion of loss in sanitary troops of the Japanese was next to that of their infantry. One of the most notable results of the Manchurian experience was the demonstration of the comparatively benign effects of the modern rifle bullet on the human body, as shown by the large proportion of comparatively slight wounds and the small proportion that subsequently died therefrom. The Russians lost 3.2 per cent. of their wounded by death, and the Japanese,

6.8 per cent., whereas in 1870–71 the Germans lost 11 per cent., and in the Civil War the Union side lost 13.2 per cent. Much of the improvement in this respect is undoubtedly due to better surgical treatment, but the fact remains that the small modern bullet is less liable to produce a fatal result, as the wounds caused thereby are not so easily infected on account of the comparatively small size of the openings, and also because the narrower track is less liable to involve contiguous vital parts.

There is some foundation for the belief, based upon the experience in Manchuria, that in future wars the proportion of wounds inflicted by artillery will be greater than in the Civil War or the Franco-Prussian War, in which the proportion of wounds caused by shell and shrapnel amounted to 9.9 per cent. and 8.4 per cent., respectively. Some observers have estimated that the proportion of artillery wounds in the Russo-Japanese War reached about 15 per cent. The proportion of wounds caused by weapons other than firearms was small, 1.7 per cent. for the Russians and 3 per cent. for the Japanese.

It would appear that the battles in the Far East were so "bloody" not only because of their longer duration, but also on account of the high efficiency of the weapons used.

The personal equation of the contestants must, however, be taken into account if the casualty figures of the Manchurian War are to be used as a basis for estimating probable losses in future wars. It must be recognized that the Japanese were deliberate but most persistent assailants and the Russians were equally stubborn defenders. Whether or not the same tactics would be used by others in a future war is a subject only for idle speculation.

With a full knowledge of the published results of the last war and from personal experience in Manchuria, competent observers have expressed the opinion that the proportion of casualties in future wars will not differ materially from those sustained in earlier wars, and the deductions drawn from most carefully prepared statistics of our Civil and the Franco-Prussian Wars may still be used as a guide.

For the purpose at hand it is quite important to endeavor to determine the "ordinary maximum casualty" that troops are liable to sustain, to be used as a basis for calculating the amount of personnel and supplies needed. It must be emphasized that there is no reason for the belief that in future wars the morale of our troops will be any different than in the past, or that they will bear any greater proportion of losses. As a matter of fact, it is stated upon good authority that troops will not ordinarily maintain their firmness after a loss of 10 per cent. of their number, and anything beyond that usually means a local or general disaster. This perhaps, explains the reason that a loss of 10 per cent. is usually assumed in theoretical battle problems.

Taking the casualty statistics of previous wars as a basis, it may be assumed that the maximum casualties to be expected in various sized organizations, great disasters excluded, are about as follows:

For an army corps (about 40,000 men).....20 to 25 per cent.
For an infantry division (about 20,000 men).....25 to 30 per cent.
For a regiment (about 1,500 men).....40 to 60 per cent.

While the loss of a division may amount to 20 per cent. or more, it does not follow that the casualties will be evenly distributed among the various organizations of which it is composed More than one-half may be wounded in one group or small area of the field, some regiments sustaining enormous loss and others very little. This is an important point to remember as it affects the distribution of the divisional medical units on the field.

Such figures are also of importance in making estimates of the probable needs of personnel, supplies, transportation and hospital accommodations for units of various strengths for an impending serious engagement.

The distribution of the total number of causalties into proper categories is also necessary when the attempt is made to estimate the amount of transportation and hospital space that may be

needed at the front. The proportion to be included in each class has been variously estimated and some rather extravagant statements have been made in reference thereto. For instance, it was maintained by some that the Manchurian campaign showed that 75 per cent. of all the wounded would be able to reach the dressing stations, field hospitals, or advance depot unaided. Authorities have reached no definite agreement as to the probable proportion to be expected in the future in each class. Each has apparently modified the figures obtained from the Far East to meet the probable requirement of his own particular service. The figures here given are believed to be a conservative estimate from our point of view. It must not be forgotten that the state of discipline and training has some influence on the number of wounded that can be compelled to walk some distance.

For working purposes those wounded in battle may be apportioned among four different categories:

1. The very severely wounded that cannot stand transportation, including those with abdominal wounds and other serious injuries accompanied by marked symptoms of shock. The transportation of such cases in vehicles to a distance would, in all probability, deprive many of them of their chance of recovery. From a service point of view, such cases are lost to the army, but humanity demands that they be given every possible care and attention. It is questionable if special efforts should be made to prevent such cases from falling into the hands of the enemy. However, wounded must not be lightly left to fall into the hands of the enemy, as the effect such action would have upon the morale of troops is not to be disregarded. Whenever practicable they should be sheltered near the place of the receipt of their injuries, and, when necessary, left with sufficient personnel and supplies under the protection of the provisions of the Geneva Convention.

2. The less severely wounded that require transportation by litter or ambulance from the field and aid stations to the dressing stations and field hospitals.

3. Wounded whose injuries are such as to permit them to walk as far as the dressing station or field hospital.

4. Wounded that are able to walk to the station for slightly wounded and to the advance depot or other designated point on the line of communications. It is gradually becoming more and more appreciated that the care and treatment of the less severe cases is of greater importance to the army in the field than that of the serious ones. A large percentage of the former may be expected to recover soon and resume duty at the front. From a strictly military standpoint it is quite necessary that these professionally less interesting and less important cases should be given great care and attention, and that the medical department should not expend all of its energies upon those that cannot be expected to render further service in the campaign.

The proportion of the various categories of battle casualties are estimated to be about as follows:

- Killed ..... 20 per cent.
- Wounded ....
  - Non-transportable ..... 8 per cent.
  - Transportable
    - Sitting ..... 20 per cent.
    - Recumbent ..... 12 per cent.
  - Walking
    - To dressing station and field hospital ..... 28 per cent.
    - To station for slightly wounded and advance depot ..... 12 per cent.

In accordance therewith, of every one hundred wounded:

10 are non-transportable.
15 require transportation recumbent.
25 require transportation sitting.
35 are able to walk to the dressing station or field hospital.
15 are able to walk to the station for slightly wounded.

As an illustration, let it be supposed that a division has sustained a loss of 10 per cent. in battle, and the strength of the division, taken in round numbers, is 20,000 officers and men; the casualties would be distributed among the various classes as *follows:*

Killed		400
Wounded:		
Non-transportable	160	
Requiring transportation	640	
Able to walk to dressing station or field hospital	560	
Able to walk to station for slightly wounded and advance depot	240	1600
Total		2000

Should the loss reach 25 per cent., which is by no means uncommon, the result would be as shown below:

Killed		1000
Wounded:		
Non-transportable	400	
Requiring transportation	1600	
Able to walk to dressing station or field hosptal	1400	
Able to walk to station for slightly wounded and advance depot	600	4000
Total		5000

Casualties from Disease.—From a study of the morbidity statistics of great campaigns a basis has been found for making estimates as to the probable number of cases of sickness that may be expected in a given period, so that the necessary preparation for their care and treatment may be made. It must be understood that the figures quoted below apply only to fairly well-seasoned troops operating under normal conditions of climate and service, and in the absence of epidemics of infectious diseases. Experience has shown that during the first days of a campaign these figures are largely exceeded and reach a normal only after the weaklings have been weeded out and the troops have become hardened. In the first few hard marches the losses may be from 5 to 10 per cent. of the force.

It can hardly be expected that such estimates will accurately apply to any specific case, yet the experience of past campaigns gives the only rational basis for calculation. It is reasonable

to believe that the value of the factors given in the calculations can, after some experience in a campaign, be modified to correspond to the actual situation.

For the present purpose the sick are classified as follows:

1. Sick in quarters { Able to do light duty: Class (a)
   Unable to do any duty: Class (b)
2. Hospital cases.. { Slight.....Class (c)
   Severe.....Class (d)

Class	Daily admission per 1000	Duration of treatment in class	Average number of days in class	Day when maximum number is reached
(a)	3	3 days	3	4
(b)	3	3 to 5 days	4	6
(c)	1.5	5 to 14 days	10	15
(d)	1.5	14 to 50 days	32	51

It would appear from the above table that the maximum number of cases in class (a), for instance, would be reached on the fourth day, and thereafter the admissions and discharges would balance. Discharge from a class does not necessarily mean that the patient was returned to duty, as it includes deaths and transfers to another class. In the latter case, it would constitute, as far as these figures are concerned, a new admission in the category to which he was transferred.

From Cron and Hochman's exhaustive study of the morbidity statistics of the Franco-Prussian and antecedent wars, the table given above and the following tables are taken:

Sick in Quarters.

(Classes "a" and "b.")

1. Daily admissions, 6 per 1000

2. Number constantly sick after fifth day, 21 per 1000
3. Average duration of illness, 4 days
4. Dropped daily, from number on hand on previous day, 30 per cent.

Sick in Hospital.

(Classes "c" and "d.")

1. Daily admissions, 3 per 1000
   Of these:
   Non-transportable, 1/12
   Permanently disabled, 1/20
2. Number constantly sick, after fiftieth day, 63 per 1000
3. Average duration of illness, 28 days
4. Dropped daily, from number on hand on previous day, 5 per cent.

Total Sick.

1. Daily admissions, 9 per 1000
   Of these:
   Non-transportable, 1/36
   Permanently disabled, 1/60
2. Total number of sick, after troops have been in service for a more or less prolonged period, 84 per 1000

In consequence of the more efficient sanitary methods now at our disposal, it is believed, however, that in future campaigns much better sanitary results will be obtained under normal conditions.

Our recent experience with the larger bodies of troops mobilized on the Mexican frontier shows that much more can now be

done to maintain a high effective strength of troops serving in the field.

The troops referred to were operating under service conditions, with the exception that no battles were fought, and the constant non-effective rate was surprisingly small. At the end of four months of hard service, usually under unfavorable conditions of weather, only 24.2 per thousand were non-effective from sickness and injuries. Such results could not, however, be expected in actual campaign when strict sanitary regulations could not be observed. The rather exceptional results obtained in these camps were undoubtedly due to the administration of the typhoid prophylactic, combined with efficient camp sanitation.

By making due allowance for the reduced admission rate resulting from increased efficiency of sanitary methods, the tables given may still be used as a guide for estimating the provision to be made for the care of sick in a campaign, as there is no adequate ground for the belief that the probable duration of illness will be much shortened.

The above-mentioned authors have deduced an ingenious formula for calculating the probable number of hospital cases that will be on hand at any time previous to the date when the maximum number will be reached. As noted above, admissions and discharges from hospital will balance on and after the fifty-first day, consequently the maximum number of hospital cases, under normal conditions, will be reached at that time. The formula is given as follows:

$$\frac{nA}{2} - \left(\frac{A}{20} \times \frac{(n-14)}{8} \times (4+n-14)\right) = \text{number of hospital cases on the nth day.}$$

n the desired day upon which the number of hospital cases is to be estimated.

A the daily admission rate per thousand.

Thus, let it be assumed that a force of 20,000 well seasoned men are entering into active operations, and it is desired to make an estimate of the probable number of hospital cases that have to be provided for by the thirtieth day, the equation would read:

$$\frac{30A}{2} - \left(\frac{A}{20} \times \frac{(30-14)}{8} \times (4+30-14)\right) = 13A = \text{number of hospital cases on the thirtieth day.}$$

If it is assumed that the daily admission rate (A) will be 1.5 per thousand, the number to be provided for on the thirtieth day will be 19.5 per thousand, or a total of 390 cases for the force of 20,000 men.

CHAPTER II.

PART VI.

TRANSPORTATION.

The Medical Department field service regulations remark upon the difficulties that may be expected in the efforts to relieve the troops at the front of the sick and wounded. It has often been stated that the success of the medical service in the field depends largely upon the celerity with which the command can be relieved of its encumbrance of non-effectives. Many experienced medical officers have expressed the opinion that the future progress of medical organization must necessarily be along the line of developing a more adequate transport and evacuation service. The Manchurian campaign illustrated this necessity in a marked degree, and the additional transport material that the contestants were forced to obtain was enormous in comparison to what they had at the beginning. It is recorded that during the last year or two of our Civil War some commands were allowed ambulances at the rate of one for every 150 men, and then the supply trains often had to be largely drawn upon after serious engagements. By comparison, the present allowance—one ambulance to about 400 men—seems very small, but there is now authorized on the line of communications for each division, a transport column, which formerly did not obtain.

It is a foregone conclusion that in a severe battle in which large bodies of troops are engaged, the present authorized medical department transportation will prove as pitifully inadequate as in former times. It must be remembered, however, that armies are put in the field in war time for the purpose of fighting battles and not to exploit humanitarian ideas or medical methods, and a medical department might easily be made so cumbersome that the greater good it could then accomplish in the way of better

care of wounded, would be more than offset by the hindrance it might be to the army in accomplishing its main purpose.

The medical department of a division possesses a variety of means of transportation for patients and for medical supplies, comprising ambulance wagons, field wagons, litters, pack transport, travois, etc., to which may be added ambulance carts, two mule litters, and motor vehicles.

Means of Transport of Medical Department for Infantry Division.

	Ambulance wagons	Field wagons	Litter squads	Pack mules	Travois	
Regimental (12 regs.)	.....	12	72	12	.....	.....
Ambulance company (4)	48	12	64	16	16	.....
Field hospital (4)	.....	32	.....	.....	.....	.....
Reserve medical supply	.....	6	.....	.....	.....	.....
Totals	48	62	136	28	16	.....

Cavalry Division.

	Ambulance wagons	Field wagons	Litter squads	Pack mules	Travois	
Regimental (10 regs.)	.....	10	60	10	.....	.....
Ambulance company (2)	24	6	32	8	8	.....
Field hospital (2)	.....	16	.....	.....	.....	.....
Reserve medical supply	.....	6	.....	.....	.....	.....
Totals	24	38	92	18	8	.....

Ambulances, litters, and travois may be always considered available for transporting wounded, but it is hardly to be expected under any circumstances that all medical department supply wagons can be diverted to such use. Most of those belonging to established field hospitals and to ambulance companies might be counted on for temporary use in case of emergency. It is also often considered practicable to use empty wagons of the supply train of the division—one section of about 50 wagons which must return daily to the advance base for renewal of supplies, provided that it would not be necessary for them to be diverted from their prescribed route of march. The general supply service of an army in the field is of such vital importance to its efficiency, and as it must be carried on with a minimum amount of transport, no serious interference therewith can be tolerated, even in the interest of the sick and wounded.

While there are 662 field wagons allowed an infantry division, including the wagons of the ammunition and supply trains, it would be unreasonable to expect to obtain more than a very small part thereof, and the medical department must be content, perhaps, with the empty supply section referred to. There is, however, still another source from which additional transportation for wounded may be drawn—vehicles belonging to citizens in the surrounding country, and regulations of many services provide for the systematic collection of wagons whenever a battle is imminent, and for evacuating the sick of troops on the march when the usual means are not available.

Chief surgeons are also authorized to hire transportation under such circumstances, and in some countries, as was the case in Manchuria, it may be feasible largely to extend the transport by hiring litter bearers.

The transport columns that properly belong to the line of communications would probably be largely augmented and might be called upon to assist at the front, when the special military situation permits.

From the above it may be gathered that it is not possible to give definite figures concerning the amount of transport that

might be available in a given instance, but the statements made afford some basis at least for making a reasonable estimate.

For practical purposes and for the solution of medico-military problems, it is essential that attempts be made to determine the capacity of the various means of transport and the amount of work that could be accomplished therewith. Here, again, a great difficulty arises in the effort to fix upon a normal for use as a basis for estimate. The factors concerned are subject to such great variations; the military situation, roads, cover, weather, etc., all must be considered. However, the figures quoted below are, perhaps, the best estimate that can be obtained, and in fact some of them have been practically confirmed by observers in the Russo-Japanese War, who gave special attention to the subject.

The most important element in the plan for the medical service in battle is the arrangements that have to be made for the transportation of sick and wounded; chief surgeons must make an estimate of the kind and amount of transportation that will probably be required in case a severe battle takes place. The various factors in the estimate given here would probably have to be given other values to meet local conditions and the special military situation, but a knowledge of the plans of the commander, and of the topography of the ground would simplify the problem. Formulas have been devised to facilitate such calculations and the figures and formulas given below are quite generally accepted for the purpose:

Litter Transportation.

First aid and loading,	8 minutes
March 1000 yards,	20 minutes
Unloading, delays,	15 minutes
Returning with closed litter,	10 minutes
	53 minutes
	(roughly 1 hour)

Ambulance Wagon.

Four litter cases and one sitting with driver, or nine patients able to sit up may be carried in one load. The average load (recumbent and sitting) of an army field wagon may be taken to be five patients.

Loading 4 recumbent and one sitting,	5 minutes
Driving 2000 yards,	18 minutes
Unloading and exchanging litters,	5 minutes
Return, delays,	10 minutes
	38 minutes

To calculate the time required with a given amount of transportation for evacuating a certain number of wounded to a designated point, the following formula may be used:

$$\text{Time required} = \frac{w \times t}{m \times n}$$

To obtain the amount of transportation required in a given time for evacuating a certain number of patients, the following formula may be used:

$$\text{Number of units of transport required} = \frac{w \times t}{T \times n}$$

m = the number of units of transport material (ambulances, wagons, carts, etc.)

T = the time allowed or required.

w = the number of wounded.

t = the time taken by the vehicles used for transport.

n = the number of patients each unit carries.

As an illustration, let it be supposed that 200 wounded are to be transported by the 12 ambulances of an ambulance company from a dressing station to a field hospital located three miles away, and it is desired to know the time necessary for accomplishing the task, assuming that an ambulance wagon requires 2 hours to make a round trip. From the figures given in the chapter on casualties it would appear that 75 of the 200 led requiring transportation would have to be carried lying

on litters and the remaining 125 sitting up. By using the second formula the following figures are obtained:

$$\text{Recumbent } \frac{75\times 2}{12\times 4} = 3 \text{ hours and } 8 \text{ minutes.}$$

$$\text{Sitting } \frac{125\times 2}{12\times 9} = 2 \text{ hours and } 19 \text{ minutes.}$$

Total time required 5 hours and 27 minutes.

Should the problem be to ascertain the number of ambulances required to move that number of patients in three hours, the second formula would apply:

$$\text{Recumbent } \frac{75\times 2}{3\times 4} = 12.5$$

$$\text{Sitting } \frac{125\times 2}{3\times 9} = 9.7$$

Total 22.2

23 ambulances would therefore be needed.

The same formulas may also be applied in the case of litter squads. Supposing it is desired to ascertain the time necessary to move 200 litter cases to a dressing station 2000 yards distant, and that the 64 litter squads of the ambulance companies are available for the purpose. Using the first formula, the result would be:

$$\frac{200\times 1.5}{64\times 1} = 4 \text{ hours and } 40 \text{ minutes.}$$

In the same manner the capacity of, or the time required by trains and boats can be estimated.

CHAPTER III.

ORGANIZATION.

CHAPTER III.

ORGANIZATION.

Although the details of army organization are fully set forth in Field Service Regulations, it is nevertheless deemed expedient to review some of the leading points preliminary to a special consideration of medical organization.

It is to be noted that the organization of units higher than the regiment is not fixed by law, but is subject to change upon the authority of the President and the War Department. The composition of the larger units varies according to the special necessity. The facts and figures quoted may, however, be considered to express the average or normal organization.

	Company		Battalion		Regiment	
	Officers	Enlisted men	Officers	Enlisted men	Officers	Enlisted men
Infantry.....	3	108	15	440	51	1500
Cavalry.....	3	86	15	351	53[1]	1188
Field artillery...	5	171	18	531	44[1]	1126
Engineers.....	4	164 (100)[2]	15	501 (309)[2]	.....	.....
Signal troops....	4	100	11	207	.....	.....

[1] Includes 2 veterinarians.

[2] Cavalry division.

In computing the strength of divisions and field armies the civilian clerks and drivers are included, as they are entitled to the same medical care and attention in the field as the enlisted personnel.

The company and regiment are both administrative and tactical units. Battalions and brigades are, as a rule, tactical only, and the staff of a brigade commander usually consists of a brigade adjutant and two aids only.

A normal brigade consists of the headquarters and three regiments of infantry—approximately 4740 officers and men (sanitary troops included).

The division comprises 19,850 officers and men, including sanitary troops, civilian drivers and clerks, and are distributed among organizations as follows:

TABLE NO. 1.

The Division.

Organizations	Officers[1]	Enlisted men	Civilians	Totals
Division headquarters	12	9	13	34
Three brigades infantry (9 regs.)	498	13716	6	14220
1 regiment cavalry	57	1212	.....	1269
1 brigade field artillery (2 regs.)	95	2294	2	2391
1 pioneer battalion (3 cos.)	18	510	.....	528
1 field battalion signal troops (2 cos.)	13	213	.....	226
4 ambulance companies	21	318	.....	339
4 field hospitals	21	230	.....	251
Service of Supply.				
Officers and assistants	13	8	35	56
Ammunition train	2	8	180	190
Supply train[2]	2	15	216	233
Bakery train	.....	.....	99	99
Pack train	.....	.....	14	14
	752	18533	565	19850

[1] Inclusive of medical officers, chaplains, and veterinarians.
[2] Inclusive of medical reserve supply.

Cavalry Division.

Organizations	Officers[1]	Enlisted men	Civilians	Totals
Division headquarters	12	9	13	34
3 brigades (9 regs.)	516	10908	6	11430
1 reg. horse artillery	47	1147	.....	1194
1 pioneer battalion (3 cos. mtd.)	18	318	.....	336
1 field battalion, signal troops (2 cos.)	13	213	.....	226
2 ambulance cos	10	158	.....	168
2 field hospitals	10	114	.....	124
Service of Supply.				
Officers and assistants	9	8	36	53
Ammunition train	2	8	108	118
Supply train[2]	2	15	108	125
Pack trains (2)	.....	.....	28	28
Totals	639	12898	299	13836

A field army is the next higher field organization and is composed of two or more divisions, to which are ordinarily added a cavalry division or brigade and an auxiliary division. This unit takes the place of the army corps formerly authorized. The organization of the auxiliary division depends so much upon the special situation that only an estimate can be made of its probable strength.

[1] Includes medical officers, chaplains, and veterinarians.

[2] *medical* reserve supply.

An Auxiliary Division.

For a field army composed of two infantry divisions and a cavalry brigade (estimated):

Organizations	Officers	Enlisted men	Civilians	
Headquarters	11	9	18	
1 regiment infantry	55	1524		
1 regiment heavy artillery	47	1147		
1 ponton battalion	18	510		
1 aero-wireless battalion	13	213		
Supply service	4	8	19	
1 ammunition train	1	4	68	
1 supply train	1	4	102	
1 ambulance company	5	79		
1 field hospital	5	57		
Totals	160	3555	207	
Grand total				3922

Two or more field armies may, upon the authority of the President, be combined to form an *army*. The headquarters staff thereof will be such as may be deemed necessary by its commander.

A field army composed of 2 divisions, a cavalry brigade and an auxiliary division, would constitute a force of about 47,466 officers and men, distributed as follows:

Organizations	Officers	Enlisted men	Civilians
Headquarters	20	11	3
2 divisions	1504	37066	1130
1 cavalry brigade	172	3636	2
1 auxiliary division	160	3555	207
Totals	1856	44268	1342
Grand total			47466

The line of communications corresponds to the medical evacuation zone and is the route on which troops and supplies are sent from the base to the zone of operations, and sick and wounded are evacuated to the rear. A line of communications is established for each field army or important expeditionary force, and is under the control of the commander of such army or force, and directly under a commander who controls the troops pertaining thereto.

Medical Department Organization.

Important changes have been made by the new Field Service Regulations in the organization of the medical department of troops in the field. It will be observed that the number of medical officers attached to regiments has been increased from three to four, two have been added to each ambulance company, and the latter organization no longer constitutes a section of the field hospital, but is now a separate unit. With the exception of brigades acting independently, the position of brigade surgeon has been abolished, and a director of field hospitals and a director of ambulance companies have been added to the division organization. The latter mentioned authorities perform in a general way the function of battalion commanders, but

neither the four divisional ambulance companies nor the four field hospitals are to be considered as administrative units.

No special organization is provided to establish the station for slightly wounded, but the personnel therefor is to be drawn from the sanitary personnel of regiments or trains.

The total number of medical officers of a division has been increased from 81 to 101.

The regimental detachment of the hospital corps of infantry and cavalry regiments has been increased from 3 non-commissioned officers and 9 men to 4 non-commissioned officers and 20 men, and artillery regiments (consisting of two battalions) are allowed 3 non-commissioned officers and 18 men. Ambulance companies are given two additional orderlies for medical officers. The number of non-commissioned officers and men of the hospital corps of a division has been increased from 711 to 877.

The personnel of the medical department is collectively called *sanitary troops*.

Field Service Regulations do not prescribe the number and rank of the staff officers of an *army*, but it is to be presumed that it will conform to that of a field army, except the staff officers will be of higher grade.

The sanitary personnel of the headquarters of a *field army* include:

1 Colonel, chief surgeon.
1 Colonel, inspector.
2 Majors, assistants.
2 Sergeants, 1st class, clerks.
9 Privates, 1st class and privates, orderlies and drivers.

Of a division:

1 Lieut.-colonel, chief surgeon.
1 Lieut.-colonel, inspector.
1 Major, assistant.
1 Captain, assistant.
1 Sergeant, 1st class, clerk.
6 Privates, 1st class or privates, clerks and orderlies.

The sanitary troops of a division are divided into those assigned to regiments or other organizations, and those formed into independent sanitary units, such as ambulance companies and field hospitals, as shown below:

Sanitary Personnel with Regiments and Battalions.

Organization	Majors	Captains or lieutenants	Total commissioned	Sergeants 1st class	Sergeants	Privates 1st class and privates	Total enlisted
Infantry or cavalry regiment	1	3	4	1	3	20	24
Field artillery reg	1	2	3	1	2	18	21
Engineer battalion (3 cos.)	....	3	3	.....	3	6	9
Signal battalion (2 cos.)	....	2	2	.....	2	4	6

Medical Department Units.

Ambulance co	....	5	5	2	7	70	79
Field hospital	1	4	5	3	6	48	57
Reserve medical supply	.....	1	1	1	1	9	11

Total Sanitary Personnel and Transportation of a Division and of a Cavalry Division. (Sec. 33, F. S. R.)

(a) Division.

	Personnel									Transportation		
	Lieutenant-colonels	Majors	Captains and lieutenants	Total commissioned	Sergeants 1st class	Sergeants and corporals	Pvts. 1st class and privates	Total enlisted	Grand total	Ambulances	Wagons	Pack animals
Division Hq	1	1	1	3	1	..	6	7	10	..	..	..
Inspection	1	..	....	1	....	1	1	2	3	..	..	..
Infantry, 9 regs	....	9	27	36	9	27	180	216	252	..	9	9
Cavalry, 1 reg	....	1	3	4	1	3	20	24	28	..	1	1
Artillery, 2 regs	....	2	4	6	2	4	36	42	48	..	2	2
Engineers, 1 bn	....	..	3	3	....	3	6	9	12	..	..	..
Signal troops, 1 bn	....	..	2	2	....	2	4	6	8	..	..	..
Ammunition train	....	..	2	2	1	1	6	8	10	..	..	..
Supply train	....	..	1	1	....	1	3	4	5	..	..	..
Ambulance cos. (4)	....	1	20	21	8	29	281	318	339	48	12	16
Field hosp. (4)	....	5	16	21	12	25	193	230	251	..	32	..
Reserve supplies[1]	....	..	1	1	1	1	9	11	12	..	6	..
Total	....	2	19	80	101	35	97	745	877	978	48	62	28

(b) Cavalry Division.

Division Hq	1	1	1	3	1	....	6	7	10	..	..	..
Inspection	1	..	....	1	....	1	1	2	3	..	..	..
Cavalry, 9 regs	....	9	27	36	9	27	180	216	252	..	9	9
Horse artillery, 1 reg	....	1	2	3	1	2	18	21	24	..	1	1
Engineer bn. (mtd.)	....	..	3	3	....	3	6	9	12	..	..	..
Signal bn	....	..	2	2	....	2	4	6	8	..	..	..
Ammunition train	....	..	2	2	1	1	6	8	10	..	..	..
Supply train	....	..	1	1	....	1	3	4	5	..	..	..
Ambulance cos. (2)	....	..	10	10	4	14	140	158	168	24	6	8
Field hosps. (2)	....	2	8	10	6	12	96	114	124	..	16	..
Reserve supplies[1]	....	..	1	1	1	1	9	11	12	..	6	..
Total	....	2	13	57	72	23	64	469	556	628	24	38	18

[1] With supply train.

SANITARY TROOPS AND TRANSPORTATION OF A FIELD ARMY ORGANIZED AS FOLLOWS:

(Approximately 47,466 officers and men.)

Organizations	Colonels	Lt.-colonels	Majors	Captains or lieutenants	Total commissioned	Sergeants 1st class	Sergeants	Pvts. 1st class and privates	Total enlisted	Ambulances	Wagons	Pack mules
Headquarters	2	..	2	....	4	2	....	9	11	1	1	
2 divisions	..	4	38	160	202	70	194	1490	1754	96	124	56
1 cavalry brigade	..	..	3	9	12	3	9	60	72	....	3	3
Auxiliary division	..	..	4	22	26	8	25	172	205	12	12	6
Totals	2	4	47	191	244	83	228	1731	2042	109	140	65

No attempt is made to give a detailed organization and strength of the troops to be employed on the line of communications. It is impracticable even to attempt to estimate the length and character of the line, as the military situation determines the organization and force to be used. This is not a matter of great importance, so far as the medical service is concerned, because the medical organization is based largely upon the strength of the field army or large expeditionary force which the line of communications is to serve.

The medical department of the line of communications is headed by a chief surgeon with one or more medical officers as assistants, and a number of non-commissioned officers and privates of the hospital corps as clerks and orderlies. A sanitary inspector is also assigned to the headquarters staff. One or more consulting surgeons and sanitarians, specially qualified volunteer medical officers of high rank, but having no administrative responsibility, may be added as professional consultants and advisers.

The medical organization comprises:

Transport columns.

Evacuation hospitals.

Base hospitals.

Supply depot.
Hospital trains.
Hospital boats.
Red Cross field columns.

One transport column, two evacuation hospitals, one base hospital, and one supply depot is allowed for each division comprising the field army served by the line of communications, and hospital trains and boats may be added whenever desirable and practicable.

The Red Cross organizations, which are not usually called upon for service in the zone of operations, are used to supplement the regular institutions and to assist in the care and transportation of sick and wounded on the line of communications and at home. They also establish rest and food stations whenever necessary on the line of communications or further in rear.

Personnel and Transportation of Sanitary Organizations on Line of Communications.

Organizations	Colonels	Lt.-colonels	Majors	Captains and lieutenants	Total commissioned	Sergeants 1st class	Sergeants	Pvts. 1st class and privates	Total enlisted	Female nurses	Ambulances	Wagons	Cars	No. of beds
Transport column.	..	..	1	3	4	4	16	64	84	..	12	3	..	....
Evacuation hospital.	..	1	..	13	14	8	16	129	153	..	3	2	..	324
Base hospital.....	1	..	1	18	20[1]	8	16	129	153	46	3	2	..	500
Supply depot.....	..	..	..	2	2	1	2	12	15	..	..	..	..	....
Hospital train	..	..	..	3	3	1	2	24	27	..	..	..	10	200
Hospital ship.....	..	..	1	4	5	1	4	35	40	..	..	..	..	200
Red Cross.....							Not fixed							

[1] Including 1 dentist.

TRAINS.

Excluding the ammunition train, the means of transportation for the materials and supplies of an entire division comprises 527 vehicles and 408 pack mules, which are distributed among the combat, field and supply trains.

Combat trains[1] consist mainly of those wagons or vehicles assigned, ordinarily, to battalions and squadrons for the purpose of supplying troops with extra ammunition, intrenching tools, etc., needed in actual combat; they also include the special vehicles provided for engineer and signal troops.

As a rule, combat trains march immediately in rear of the battalion units to which they are assigned, although when an engagement is probable they may be assembled in rear of their regiments.

The **field train**[2] of a division (including sanitary wagons) consists of about 365 wagons carrying baggage, and at least two days' subsistence and three days' forage for the entire command.

When wagons of the field train are emptied they are available for use in obtaining additional supplies, and in case of emergency, for the transportation of wounded.

The field train is ordinarily divided into brigade sections which follow their respective brigades. However, when there is a probability of contact with the enemy, the entire train may be assembled in rear of the column of troops of the division.

The **supply train**[3] of a division consists of 162 wagons. The subsistence and forage wagons of the train are grouped in three sections, each section carrying one day's supply for the entire division. The medical reserve (6 wagons) and field bakery (15 wagons) generally accompany the supply train.

When it becomes necessary to draw upon the supply train, one section moves up and turns supplies over to the field trains or makes issues direct.

When a supply section is emptied it proceeds to the supply

[1] F. S. R., 234.
[2] F. S. R., 230.
[3] F. S. R., 236.

PLATE I.

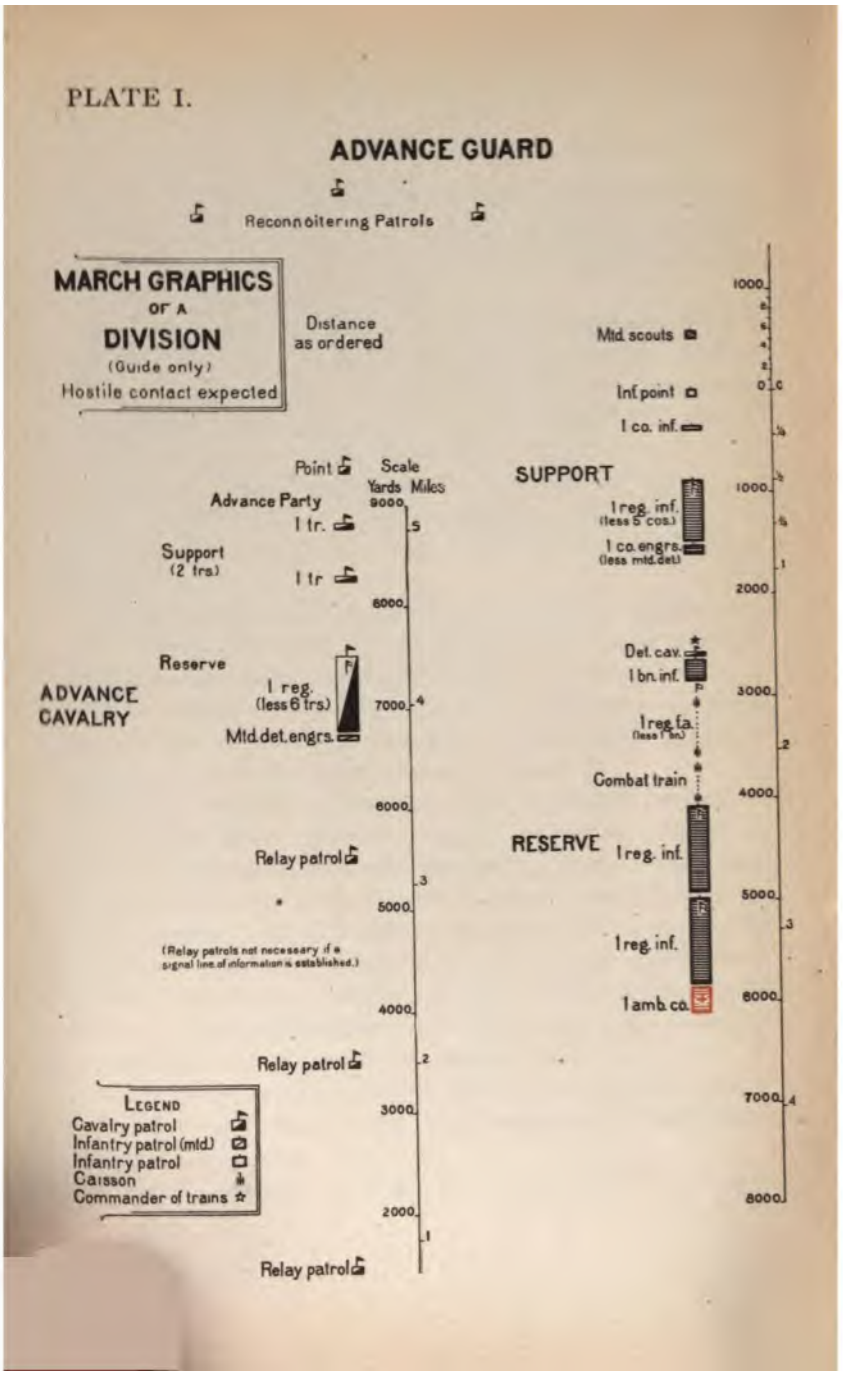
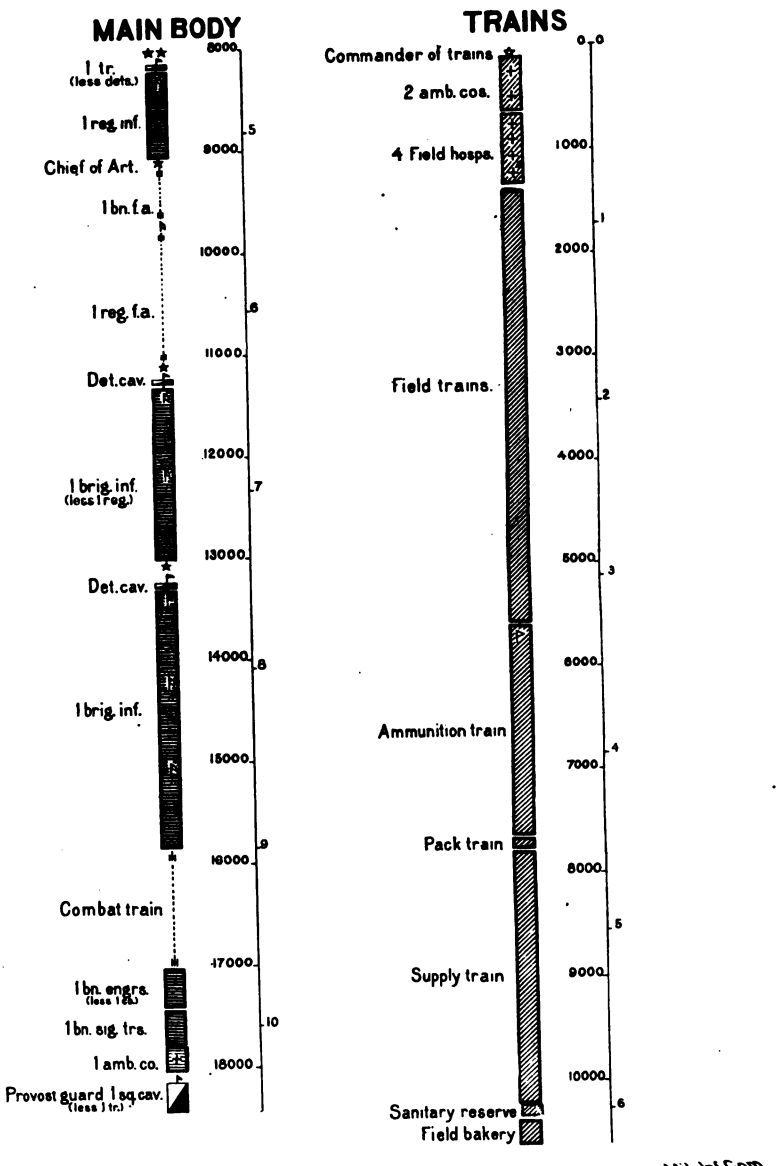

ADVANCE GUARD
Reconnoitering Patrols
MARCH GRAPHICS
OF A
DIVISION
(Guide only)
Hostile contact expected
Distance
as ordered
Point
Advance Party
1 tr.
Support
(2 trs.)
1 tr
Reserve
ADVANCE
CAVALRY
1 reg.
(less 6 trs.)
Mtd. det. engrs.
Relay patrol
(Relay patrols not necessary if a signal line of information is established.)
Relay patrol
Relay patrol
LEGEND
Cavalry patrol
Infantry patrol (mtd.)
Infantry patrol
Caisson
Commander of trains
Scale
Yards Miles
9000
6000
7000
6000
5000
4000
3000
2000
1
2
3
4
5
Mtd. scouts
Inf. point
1 co. inf.
SUPPORT
1 reg. inf.
(less 5 cos.)
1 co. engrs.
(less mtd. det.)
Det. cav.
1 bn. inf.
1 reg. f.a.
(less 1 bn.)
Combat train
RESERVE
1 reg. inf.
1 reg. inf.
1 amb. co.
1000
0
1000
2000
3000
4000
5000
6000
7000
8000
1/2
1
2
3
4

PLATE. I.—(*Continued.*)



Mil Inf Com.

depot as rapidly as possible. A train of about 50 wagons would thus often become available for use in evacuating sick and wounded from the front to the advance base, and the division surgeon must endeavor to make arrangements for such service whenever necessary.

The regimental medical supply wagon and pack mule, the ambulances and wagons of the ambulance companies, and the medical supply wagons of the field hospitals are analogous to combat trains.

Regulations provide that the regimental medical supply wagon, as a rule, marches with the field train. When an engagement is in prospect, it must be brought up, however, and kept in contact with its unit. Otherwise the supplies carried therein would not be available at a time when most needed.

When marching in the presence of the enemy, the ambulance companies with their ambulances may be incorporated in the column of troops. When they are required to proceed with light transportation only (pack mules), the ambulances march ordinarily in advance of the field trains. Ambulances may also be distributed among the various regiments in the column, but when contact with the enemy is imminent they are again assembled.

Ambulance companies and field hospitals generally march in rear of the division field train, but if an engagement is in prospect they usually precede it.

The six reserve medical supply wagons, formerly referred to in regulations as the advance medical supply depot, march with the supply train.

Plate I shows the order of march and the road space occupied by a division with its trains, marching on a single road in presence of the enemy. It will be observed that the distance from the infantry point to rear end of supply train is approximately 16 miles.

CHAPTER IV.

ADMINISTRATION

CHAPTER IV.

ADMINISTRATION.

The medical department of an army in the field has four functions, viz.:

1. Sanitation.
2. Professional care and treatment of sick and wounded.
3. Providing medical and hospital supplies.
4. Collection and evacuation of sick and wounded.

This discussion will be largely confined to the service indicated in the fourth heading—the collection and evacuation of sick and wounded from the zone of operations; in other words, to such duties as cannot properly be classed under the head of sanitation or other strictly professional subjects. It relates almost exclusively to administrative functions which have as their ultimate object to bring the patient, the facilities for his treatment, and the surgeon in conjunction under the most favorable possible circumstances. That and the supervision of sanitation are largely implied when the administrative duties of medical officers are mentioned. From a strictly military point of view, such duties are of the greatest importance, and an efficient service of this kind not only enhances the mobility of troops by relieving them of the encumbrance of sick and wounded, but incidentally increases the effectiveness of a force by preventing spread of infectious disease at the front, and also by the good effect the removal of sick and wounded has upon the morale of troops.

Baron von Schellendorf, in his "Duties of the General Staff," pointedly remarks that "the system of evacuating sick (and wounded) forms the basis of the entire medical service in the field." In practice it will not be possible, however, to separate this service from that given under the second and third headings, as patients will need care, treatment and certain medical supplies while in process of being taken to institutions in the rear.

The service of the evacuation of sick and wounded naturally falls into three well-marked zones:

(a) Collecting.
(b) Evacuating.
(c) Distributing.

The first, or collecting zone, corresponds to the zone of active operations; the second, or evacuating zone, to the line of communications, and the third to the home territory. No very distinct line of demarkation can, however, be drawn between the different zones as they are bound to overlap more or less. Consequently an article of this kind, which purports to deal with the service at the front, must also give some consideration to that of the line of communications.

The various organizations of sanitary troops provided for the purposes noted above in the three zones, are as follows:

Collecting Zone:

1. Regimental detachments.
2. Ambulance companies.
3. Field hospitals.
4. Reserve medical supply trains.

Evacuation Zone:

1. Transport columns.
2. Evacuation hospitals.
3. Sanitary supply depots.
4. Hospital trains and boats.
5. Base hospitals.
6. Base supply depots.

Distributing Zone:

1. Hospital ships and trains.
2. General hospitals.
3. Supply depots.

The service of the three zones is supervised and co-ordinated by the surgeon general of the armies in the field, under the supervision of the Surgeon-General of the army.

Chief surgeons exercise general supervision and control over the entire medical service of their respective commands, including sanitation, care and treatment of sick and wounded, proper supply of all medical department units, and relieving the army of non-effectives.

The responsibility for the evacuation service rests with the chief surgeon of the *army* who gives general instructions to chief surgeons of field armies. They, in turn, convey them wholly or in part to division surgeons, and to chief surgeons of lines of communication. Chief surgeons of field armies and division surgeons are the two authorities more directly concerned in devising the detailed plans or schemes for use of medical department units at the front. Chief surgeons are members of the staffs of their respective commanders, and are expected to advise the latter upon all matters pertaining to their particular service. Under par. 291 F. S. R., they may be authorized to issue orders to their subordinates in the name of the commander. They must keep themselves constantly informed of the military situation and of the plans and intentions of their commanders, in order that timely preparation may be made for projected movements and operations.

The Division Surgeon.

The division is the great administrative and tactical unit and forms the basis of army organization. It follows that the division surgeon is in a corresponding position of great responsibility, and under the direction of his commander and of the chief surgeon of the field army, supervises and controls the entire sanitary service of his division, in camp, on the march, and in battle. Based upon the instructions received from the chief surgeon of the field army, and a knowledge of the situation as communicated to him by his commander or chief of staff, he must devise and carry out a plan for a systematic evacuation of non-effectives, and for the proper use of medical department units. To assist him in administering the medical affairs of the division, he is aided by the sanitary inspector, directors of field

hospitals and of ambulance companies, and by two medical officers specially detailed for duty in his office.

The division surgeon must arrange a systematic and orderly service for the care and disposal of the sick on the march, and must be prepared to give definite instructions to accomplish this result.

Upon the recommendation of the division surgeon, the place or places where the sick are to be assembled, and whence they are to be sent to a hospital for treatment should be designated in paragraph 4 of march and camp orders. The details of the method to be pursued, the designation of the personnel and transportation, the time and place when the latter are to rejoin the column, etc., must be provided for in special orders and instructions.

Unless the entire division is compactly camped, it is usually advisable to fix upon an assembly point for each brigade to which patients are brought by ambulance or litters. As these collecting places are not usually expected to continue in function more than a few hours at the most, no considerable personnel is needed to serve them, and one medical officer, a non-commissioned officer, and a few men are amply sufficient for each place. The personnel may be taken from a field hospital or ambulance company, or from a regiment marching near the head of the column, so that a place may be prepared for such patients as may fall out during the day's march.

The division surgeon, being in constant touch with the chief surgeon of the line of communications, would at once notify him of the number of cases that will require transportation to the rear, so that immediate steps may be taken to remove them.

In the attempt to maintain the highest possible effective strength, much work and responsibility is thrown upon the medical department, and the division surgeon must impress upon regimental medical officers the urgent necessity of pursuing a rigorous policy in the selection of cases for evacuation.

Patients falling out during the march and those reporting a sick call are to be classified in three categories:

1. Trivial cases that may be expected to recover in a few days.

2. Severer cases that must be sent to the rear.

3. Non-transportable cases that must be provided for on the spot.

(1) To prevent undue depletion of the ranks, it is important that patients whose disability will probably be of very short duration should be kept with the command, except when troops are marching into action. It is a matter of common experience that much is lost in effective strength of a marching command if trivial cases are sent to institutions in the rear, especially in the case of raw troops, many of whom find the hardships and restraints of active service irksome, and are inclined to take advantage of every pretext to escape therefrom.

Some of the lighter cases may well be able to march, if relieved of their packs, and the others can be carried in ambulances and on the wagons of the trains.

(2) The severer cases and such others as cannot be expected to recover soon must be directly or indirectly turned over to the medical department on the line of communications. They are to be assembled and taken care of until they can be turned over to a transport column or other line of communication organization, or they may be sent to the rear in the empty supply wagons returning to the advance depot, and by hired transportation.

Ambulance companies should not be called upon for such service if the command is in the proximity of the enemy.

(3) The non-transportable cases, which might include infectious cases, are to be directly turned over to the sanitary troops of the line of communications. Should it be impracticable to thus dispose of them at once, it may be necessary to leave a medical officer and the necessary attendants for their temporary care, or it may be advisable to turn them over to a neighboring civil institution.

Daily orders and instructions must be issued, not only to fix the assembly points, the details of men and transportation,

but also when the latter may rejoin their commands if there is delay in transferring patients.

Like other extensive operations, the medical service of a division in battle must be conducted in accordance with a well-defined plan, which is to be formulated by the division surgeon and approved by the commander. This plan must also be thoroughly understood by all concerned in its execution.

The division surgeon being the highest medical authority that directly supervises the medical service of a division in battle, would undoubtedly be called upon to submit his recommendations to the commander or chief of staff when the battle order is to be issued. Some of these recommendations may be included in the body of the order, others would be formulated as special orders for the guidance of the medical department alone.

The division surgeon's plans for the battle service are based upon the information and instructions received from the commander of the field army or his chief surgeon, including reports from the authorities on the line of communications concerning the preparations made for the transportation and reception of sick and wounded, and the quantity and availability of supplies on hand. Furthermore, he must have informed himself of the character of the ground upon which the engagement is to take place, either by personal inspection or by a careful study of the map. He must select at least tentative locations for the stations and routes for evacuation to the rear, and the routes and means by which additional medical and surgical supplies can be sent to stations when needed.

The instructions that he expects to receive from the chief surgeon of the field army would probably cover the following points:

1. The evacuation of the sick that may have accumulated up to the time when troops go into action, their destination and the route by which they are to be sent.
2. The location and capacity of the hospitals that may have designated to receive the wounded of the division, and the

routes thereto. The number of evacuation hospitals that could be advanced to the vicinity of the battle-field for the relief of field hospitals.

3. The kind and amount of transportation that can be furnished from the line of communications for evacuation of the wounded of the division.

4. The place to which the slightly wounded able to march are to be directed.

5. The places along the line of evacuation where it is proposed to establish rest stations.

6. The location of the supply depots, and the arrangements made to furnish additional hospital supplies and renewal of materials expended during action.

When battle is imminent it becomes necessary for the troops who are to participate therein to be relieved of all non-effectives. The medical institutions that may have been established in the zone of operations or on the line of communications should be cleared of patients in anticipation of the large number of wounded that would in all probability soon require care and attention.

In addition to the daily quota (page 60) of severer cases that would ordinarily have to be sent to the rear, a large proportion of those usually treated in "quarters" would also have to be evacuated, as their presence under such circumstances would be a hindrance to the mobility of troops, and place additional burden upon the medical and supply departments. The division surgeon would designate an ambulance company to perform the duty of collecting them, but some other means of transportation to the rear would have to be provided, as the ambulance companies would probably soon be needed on the field. In the absence of any special arrangements made by the chief surgeon of the line of communications, the empty supply section returning to the advance depot might very properly transport such patients.

In making his plans for the battle service, the division surgeon must know where the wounded will be sent, the route thereto, and when the designated institutions will be ready to receive

them. Presumably evacuation hospitals will be established at the advance depot or some still more convenient point, or arrangements may have been made to transport the wounded by train or boat from some station easily accessible from the battle-field. The military situation and the means of transportation at the disposal of the chief surgeon of the line of communications, may permit him to advance hospitals to the vicinity of the battle-field.

Although the responsibility for the evacuation of field hospitals, and the transportation of patients to the rear rests with the latter-named authority, it is still necessary for the division surgeon to be fully informed of the preparations made. He would then be able to give the necessary directions to guide the convoys of slightly wounded, and to take advantage of any available transportation to relieve field hospitals from too much overcrowding. Such information would also be useful to him in determining the location of field hospitals, which should be convenient to the evacuation route.

In case of emergency the chief surgeon of the line of communications would be expected to provide transportation from that furnished for other purposes, or by hiring vehicles from civilians, in addition to the transportation allowed by regulations to transport columns. Should there be a convenient rail or waterway, trains or boats would be used; this would make the transport problem much more simple than when only wagon transportation to the advance depot could be relied upon.

The destination of the "sick in quarters" that may have to be sent to the rear and of the slightly wounded must also be specially designated. It is undesirable that such cases should be sent far back with the severe cases that cannot reasonably be expected to return to the ranks soon.

A knowledge of the location of the proposed rest stations is of assistance to the division surgeon in formulating his instructions for the service, and the evacuation of the collecting station for slightly wounded.

The sanitary supply depot, usually located at the advance

supply depot, would be expected to renew the supplies expended during action and such additional material as may be necessary for the wounded that may have to remain some days in field hospitals. The reserve medical supply wagons from the train would be sent there as soon as emptied.

Upon this information and a knowledge of the intentions of the commander, the division surgeon may formulate a scheme for the speedy rescue of the wounded, and for relieving the force of its encumberance of sick and wounded that might seriously interfere with the subsequent movements of the army. He submits to the chief of staff recommendations concerning the following points, which he desires to have included in paragraph 4 of the division field orders:

1. The time and place where the sick of the command are to be assembled for tansportation to the rear.

2. The location of the collecting station for slightly wounded.

3. The location of dressing stations and field hospitals whenever it is possible to fix them in advance.

4. The assignment of additional transportation for wounded from the train.

5. The disposition of the remaining medical department divisional units until they may be needed on the field.

It is believed to be quite essential that the above-mentioned points be covered in division field orders, for the reason that they are not only of importance to the medical department, but to every member of the command.

The great advantage of a systematic and co-ordinated service appeals to everyone, and that it may rest upon a firm foundation, the plan should be confirmed in orders that give the greatest assurance of reaching every organization.

The medical department possesses no such rapid and reliable means of communication as that afforded by field orders from division headquarters.

Some central point or points should be designated as the place where the sick are to be assembled, which place or places should be convenient to the evacuation route and where the

empty train wagons may conveniently pick them up. It is suggested that the site selected for the slightly wounded station might serve as the assembly point for the sick, as it would be possible, in all probability, to send the sick away before the influx of wounded began.

If the collecting station for slightly wounded is known to the entire command, the straggling of wounded over the country in rear of the line would be largely prevented, and the desire to accompany wounded comrades to the rear restrained.

It is not generally considered advisable to direct the definite establishment of dressing stations and field hospitals before an engagement begins, except, perhaps, in defense of strong positions. It may often be expedient, however, to order the establishment of one of each of these institutions early in action. This provides for those wounded in the development thereof, and, as suggested above, prevents the wounded from straggling over the field in search of assistance.

The additional transportation from trains, etc., assigned to the medical department should also be provided for in field orders so that there may be no difficulty or misunderstanding between medical officers and those in charge of the vehicles.

The place where the divisional medical units are held until the necessity arises for their use is also considered to be of sufficient importance to the entire command to warrant mention in the order.

The additional steps that are to be taken may be made the subject of special orders, and will be indicated in the discussion of the medical department stations and lines of assistance.

CHAPTER V.

BATTLE DISPOSITIONS.

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Every improvement in firearms has brought about a corresponding change in the style of tactics used by fighting troops, and every modification of tactics has had its influence upon the sanitary service in battle, which has for its object the speedy rescue and care of the unfortunate victims of the enemy's bullets.

Many years ago, during the time of Frederick the Great, troops advanced into battle, shoulder to shoulder, to within 200 yards of the enemy and sought to overcome him by superiority of fire, and the contestant that could fire most rapidly had the best chance of being successful. Open ground was chosen by preference and the rescue of wounded during the progress of the engagement was out of the question. "Flying field hospitals" were provided which remained with the baggage until the conclusion of the action, when the wounded were collected and cared for by the aid of troops detailed as bearers. If the action lasted until late in the day the wounded were often left on the field until the following morning.

As a result of an improvement in firearms and the experience gained therewith in our War of Independence, the so-called "linear tactics" were abandoned and troops were not massed as formerly, but were taught to take advantage of the cover afforded by the ground. It then became practicable to establish stations for the relief of wounded somewhere near the battle lines, the sanitary service in the field assumed greater importance, and surgeons and their assistants were thereafter expected to remain in closer touch.

As the range and efficiency of weapons increased and armies became larger, the difficulties of the medical service increased

in proportion to the number of wounded to be cared for, and the extent of ground to be covered in assembling them.

Until after the Cival War and the Franco-Prussian War it was the universal practice to put the first line of assistance well beyond rifle range. In the campaign of 1864 it was often provided in order that the "ambulance depots," which performed the functions of our present aid and dressing stations, should be placed 500 yards in rear of the line. In the Franco-Prussian War aid stations were often placed as far as 3000 yards in rear of the line, but it was observed that very few wounded made their way to the distant stations, as most of them preferred to conceal themselves in safe places nearer the line.

With the introduction of the small-caliber magazine rifle and the long-range rapid-fire field-piece, it became quite evident that if wounded were to receive speedy attention, the old plan of placing all medical department stations beyond the range of rifle fire was utterly impracticable. It is now a generally accepted fact that, whenever the terrain permits, the work of the rescue and care of wounded must begin within the danger zone and during the course of the engagement. The large size of modern armies, with a corresponding increase in the number of casualties, and the longer duration of battles, make it absolutely necessary that the business of relieving the distress of the wounded should begin at the earliest practicable moment.

It must be admitted, however, that a medical service in war is not organized and maintained with the sole object of meeting the humane demands of the age, that the sick and wounded soldier shall receive the same care and speedy medical attention that patients are accustomed to receive at their homes or in civil hospitals. The basis of organization of the medical department for war is the military necessity of maintaining the highest possible effective strength of an army, and of relieving it of its encumbrance of sick and wounded. The first requirement is met, in a measure, by giving the wounded treatment on the battelfield as soon as possible; the second, by rapidly evacuating all non-effectives from the zone of operations, thereby enhancing

the mobility of the army. The speedy care and treatment of wounded also serves to sustain the morale of troops by assuring them of prompt aid in case of injury. While all this would seem to be an argument for beginning relief work and establishing stations at the earliest possible moment, it must not be forgotten that at the beginning of a battle there is always more or less uncertainty as to the manner and the direction in which the engagement will develop, and as to where the sanitary service will be most needed. The division surgeon must, therefore, act with much caution and not order the establishment of stations until the military situation permits of its being done with reasonable safety, and the number of wounded on hand justify the measure. In an attack, for instance, an early establishment of aid and dressing stations would expose them to the danger of being left so far in rear as to make it impossible for them properly to fulfill their functions.

There is still some conflict of opinion as to the distance from the line of battle that stations should be established. It is still maintained by some that they should always be beyond the range of fire, but if such statements are inquired into it will usually appear that reference is had to some particular campaign which took place upon ground that afforded but little natural cover. Many reports from the war in Manchuria indicate that dressing stations and field hospitals were often located miles in rear of the line, but in nearly every case a special reason for this can be discovered, such as the fact that the engagement took place on flat ground, or a retreat was anticipated, etc.

It is sound in principle to establish the stations *as near the front as the terrain and military situation will permit.* It is a mistake to endeaver to fix a definite distance from the line for the location of stations, and it must necessarily be determined in each case by the division surgeon, whose knowledge of the situation obtained at division headquarters enables him to act with judgment and proper discretion.

The increased range and efficiency of modern weapons has also made the work of the sanitary troops much more difficult

and arduous, the danger zone behind the line having become so extended that the collection and evacuation of wounded from the field has become a great problem. It is manifestly impossible under ordinary conditions of terrain to traverse the length of the danger zone to bring surgical assistance, and to carry away the wounded without being exposed to even greater risk than that of the combatants. Consequently if wounded are not to be allowed to remain a long time on the field without surgical assistance, advantage must be taken of cover within the danger zone.

The experience in recent wars has illustrated both the importance and the difficulties of the sanitary service, and an increase in personnel and transportation facilities has recently been provided for our own and most foreign armies. The value of this service as a military factor is also being recognized, since it has become known how large a proportion of wounded will recover quickly and be able to return to the ranks, and that prompt and convenient surgical assistance restrains men from leaving the firing line to assist wounded comrades.

The chief surgeon of a field army can only outline a general scheme for the sanitary service on the field of battle, and it falls within the province of the division surgeon to regulate the details of the service within his particular sphere of action. While centralization of authority is one of the fundamental principles of the military institution, it has its limitations, beyond which it is not safe to proceed. It might be added, however, that the limits of centralization are, in a general way, measured by the executive ability of the chief. The chief surgeon of an army cannot supervise the details of a service that may be spread over a large area, and some latitude must be allowed minor authorities. The division surgeon is, therefore, made directly responsible for the way in which the service within his division is carried on, and he must obtain or, when properly authorized, issue the necessary orders concerning the establishment of stations and field hospitals, and the routes to be used for evacuating wounded from the field. Concerted action of all the

divisional units is essential to a successful service, and it remains with the division surgeon to effect the necessary co-ordination.

It is to be strongly emphasized that it is not possible to formulate fixed rules for the disposition and location of the sanitary organization on the battlefield, anymore than it is practicable to reduce battle tactics to hard and fast lines.

The type of the engagement, the character of the terrain, and the evacuation facilities, all have an important bearing upon the sanitary service on the battlefield, and the division surgeon must give them due consideration in formulating his plan for the relief of the wounded.

It is easily understood that the scheme must correspond in a general way to the tactical movements of troops as employed in a rencounter, planned attack, or defense.

A rencounter (collision of two hostile forces in movement) may develop suddenly and unexpectedly. The enemy's strength, the extent of his lines, and the ground which he occupies are probably not definitely known, and troops are put into action as they arrive on the field, and no well-defined plan of action can be determined upon until the strength, position, and purposes of the enemy are developed.

In a planned attack the conditions are much different, the enemy's position, his probable strength, and the extent of his lines have already been determined. The weakest point or points in his line may have been discovered, and the place where the main attack is to be made has been decided upon, and orders issued accordingly.

Owing to the increased efficiency of modern firearms, troops will not be able to approach each other as quickly and closely as was formerly the case, and a decision may be reached at longer ranges. Even though it were possible for a part of the line at least to get near the enemy's position by taking advantage of cover afforded by the ground, it would sooner or later become exposed to a very effective fire, as the troops on the defensive would certainly choose a position that would at least afford several hundred yards of open ground on their front. It would

be a rash commander who would attempt to cross such a space against anything like an equal force, for if his advance was checked, his force would be in danger of annihilation whether he held his ground or retreated. In any event, even if successful, the losses would be enormous. In fact, a large open space in front of a strong defensive position is generally considered to be an almost insuperable tactical obstruction.

If the terrain and the military situation are unfavorable to a frontal attack, the line may be held by a weaker force and the attempt made to flank or envelop one or both wings of the enemy. The latter course would involve extensive tactical movements which require much time for their execution, and this probably explains the long duration of some of the battles in the recent war in Manchuria. It requires much time to move a large force, as not only the troops but the ammunition, supply, and sanitary trains must be taken along. Nor can a frontal attack be carried out so rapidly as when shorter-ranged weapons were used, or as usually done in maneuvers. The assailants, as soon as they arrive within range of the enemy's guns, can advance only by taking advantage of cover afforded by the ground, or after a certain superiority of fire has been attained by the aid, perhaps, of artillery. After the line has arrived within five or six hundred yards of the enemy's position, a long delay may still be occasioned until the enemy has been sufficiently overcome to permit of the final advance.

The defender has the advantage of position and can begin an effective fire at a greater distance than the aggressor, as he is able accurately to determine the range of any point visible from his position. The difference in size of the respective targets afforded by the contestants becomes more and more accentuated as the lines approach, and the aggressors must expect to sustain much greater losses. Notwithstanding the defensive has the choice of position, it must be prepared for a variety of contingencies. The attacking force determines the time and the part of the line where the brunt of the action is to fall, and the larger the forces engaged and the longer the line, the more

difficult it will be for the defensive to bring its reserves to the proper place at the right time.

The difference in the tactics employed in the various types of engagements has a corresponding influence upon the dispositions of sanitary troops, as the character of their service is so dependent upon, and so intimately connected with the movements and operations of fighting troops.

In a rencounter the uncertain situation renders it impracticable to make any but the most general preparations for the rescue and care of the wounded, and definite steps toward establishing stations and lines of evacuation cannot be taken until the engagement has progressed to the extent that further operations or the final outcome becomes apparent. It is inadvisable even to attempt, at the beginning, to indicate locations of dressing stations or field hospitals as long as it cannot be foreseen whether the position can be maintained, or where the severe action will develop. The divisional sanitary units are to be kept in hand at a safe and convenient place until clear indications arise for their use.

In a planned attack, however, the situation is much clearer, and from the formation of troops and the orders given it may be determined where and when the greatest need for surgical assistance will probably arise, and arrangements may be made accordingly. It may not often be advisable to make complete detailed arrangements for the establishment of stations and evacuation routes, as it is not possible to predict with certainty the manner in which the action will develop, and it follows that the preparations for battle should not be strictly limited to a single possible course of events. This is especially true of the medical department, which from its relative lack of mobility is more easily enveloped or overwhelmed. Sanitary units, however, can be placed so as to be within convenient reach of prospective locations, and in readiness to establish as soon as the necessity therefore arises. The extra transportation can also be assembled at suitable places and a location for the station for slightly wounded fixed upon.

The arrangements for a division making a frontal attack must also differ from those made for a flank movement.

It is quite evident that the relief service during an attack presents most difficult problems, and the division surgeon must exercise much jugdment and caution. The continual advance of the line, the sudden variations in the military situation, and the necessity of maintaining constant touch therewith, all complicate the sanitary service.

In planned defensive actions the situation is much more simple. The ground being well known, sites for stations can be selected and prepared, and the sanitary organizations can be so placed as to be ready for immediate service when the emergency arises.

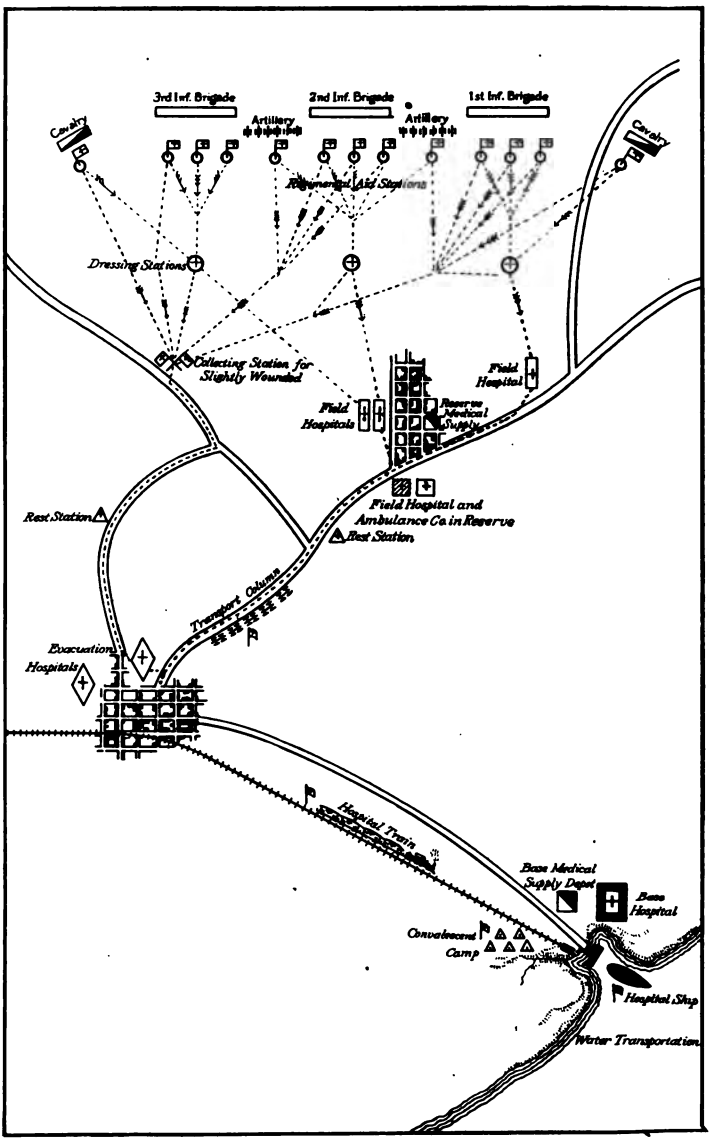
Practical experience in war has often demonstrated the fact that a successful medical service does not so much depend upon the excellence of the surgical service, as upon the efficiency of medical department administration.

It must also be emphasized that if a large number of wounded are to be taken in and cared for in a very short period of time, *the transportation of the institution to the patients, rather than the patients to the institution,* is a sound principle to follow whenever circumstances permit.

There is some diversity of opinion among experienced medical officers as to the number and variety of stations that should be established on the battlefield for the collection and care of the wounded, but the consensus of opinion seems to be in favor of as few, within limits, as possible. It is true that the more the sanitary personnel of a division is broken up into small detachments, the less the sum of work that they will be able to accomplish, but it would be foolish to ignore the experience of years and break away entirely from the methods evolved from practical experience by our predecessors, and make radical changes based upon theoretical considerations alone. The idea, however, that a fixed succession of stations should be always carried out, must be emphatically combated, as it might often happen that a combination of at least two stations would offer a decided advantage.

In addition the influence that the type of engagement and

PLATE II.


3rd Inf. Brigade
2nd Inf. Brigade
1st Inf. Brigade
Artillery
Artillery
Cavalry
Cavalry
Regimental Aid Stations
Dressing Stations
Collecting Station for Slightly Wounded
Field Hospitals
Field Hospital
Reserve Medical Supply
Field Hospital and Ambulance Co in Reserve
Rest Station
Rest Station
Transport Column
Evacuation Hospitals
Hospital Trains
Base Medical Supply Depot
Base Hospital
Convalescent Camp
Hospital Ship
Water Transportation

the character of the terrain have upon the disposition of sanitary units, the transportation facilities for the removal of wounded must be taken into consideration in formulating a plan of action. The proximity of available rail or water-ways would facilitate the execution of this most important problem connected with the battle service, and instead of providing for the care and shelter of all the more severely wounded on or near the field, stepsfcould be taken at the very beginning of the battle to provide or the evacuation of patients as soon as they fall into the hands of the medical department. The burden of the field hospitals at least would be much lightened, and their capacity would be largely reserved for the non-transportable cases. The line of communication authorities could also be expected to take the latter mentioned class over without much delay, and thus free the institutions for further emergencies.

The medical department of a division is presumably complete in itself and sufficient to meet the needs of the command in battle. It comprises, as noted in Chapter III, the administrative staff, regimental medical officers and detachments of the hospital corps, four ambulance companies, four field hospitals, and the reserve supplies carried in the supply train.

The organization is primarily provided for service in the zone of active operations, and its most important function from a military standpoint is to supervise sanitation, and to rid the force of its non-effectives. It establishes the following stations on the battlefield and the evacuation routes leading therefrom (Plate II):

1. Regimental aid stations.
2. Dressing stations.
3. Field hospitals.
4. Station for slightly wounded.

With the exception, perhaps, of the aid stations, they are established by direction of the division surgeon and supervised by the directors of field hospitals and of ambulance companies.

Regulations make no pretense of providing specific rules and

directions for the use of the various sanitary organizations on the battlefield, and indicate only a few broad general principles.

The most that can be accomplished in the following discussion as to the time of establishment and the location of stations on the field, is to indicate the various conditions and influences which must be taken into consideration in coming to a decision. It must in each specific case be left to the judgment of authority familiar with the local conditions to formulate a plan that will fully meet the requirements.

The division surgeon remains at division headquarters where he may keep himself informed of the situation from the reports received and the orders issued, and thus be prepared to take timely steps to adapt his schemes for the rescue of the wounded to the variable phase of the battle. Always keeping the main purpose of the army in mind, he must not permit any of his measures to interfere in any way with the movements of troops or ammunition, to occupy positions that may become of tactical importance, or to use roads that should be kept open for the ammunition supply service.

It is reiterated that the success of the relief service depends very much upon the rapidity with which wounded can be evacuated to the rear. The division surgeon must, therefore, make all his arrangements and dispositions to attain that object.

CHAPTER VI.

REGIMENTAL SERVICE AND AID STATIONS.

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The sanitary personnel allowed to an infantry or cavalry regiment in active service comprises a major, three captains and lieutenants, a sergeant first-class, three sergeants and 20 privates of the hospital corps. (Among these privates, the four medical officers' orderlies are included.) Artillery regiments, which are two battalion organizations, are allowed only three medical officers, three non-commissioned officers and 18 privates. This detachment is directly under the orders of the regimental commander, who, in theory at least, directs all their movements on the march and in battle. The technical duties of the regimental detachment are, however, performed under the general direction of the division surgeon, who must co-ordinate and systematize the service of the entire medical department of the division, otherwise it would not be possible to attain that concerted action which is so essential to success.

It is utterly impracticable for the division surgeon to direct the details of the regimental sanitary service. He can only indicate the general plan that has been determined upon for the relief of the wounded of the division, and the regimental surgeon must work out the details of the service within his sphere so as to fit in with the general scheme.

In practice, the senior medical officer, as a staff officer of the regimental commander, is held responsible for the proper care of the wounded at the front, and supervises and directs the work of the detachment.

During the development of an engagement, the senior medical officer must remain in constant touch with regimental headquarters, and keep himself informed of the military situation as far as the regiment is concerned, so that he may adapt his scheme for the relief of the wounded thereto. He should consult

with the commander as to the time and place of establishing a provisional or definite aid station, and as to the disposal of wounded should it become necessary to leave them behind.

If communication with division headquarters is to be had, reports of the establishment and breaking up of stations would be sent to the division surgeon or the director of ambulance companies; also the number and character of the cases on hand and the location and number of wounded left behind or sent to the rear.

The location of stations or groups of wounded may often be conveniently indicated by simple sketches on report blanks (page 37). Such reports are of special importance when collections of wounded have to be abandoned in order to maintain contact with the regiment.

On the march the surgeon rides with the regimental staff and the junior medical officers in rear of their respective battalions. The detachment of the hospital corps, orderlies excepted, is with battalions or in rear of the regiment leading the pack mule.

In battle, the senior medical officer with one assistant, the sergeant first-class, and several privates, take station at the regimental aid station. The remaining members of the hospital corps, under the supervision of the medical officers, endeavor to give assistance to the wounded on or near the firing line, and direct or transport wounded to the designated place. The members of the regimental band are also supposed to be available for bearer service during and after battle. Ordinarily not more than six litter squads can be turned out from the regimental detachment—two squads under a non-commissioned officer for each battalion. The remaining enlisted men serve at the aid station and as orderlies.

The regulation regimental medical supplies for the regimental dispensary and for the aid stations are carried on the supply wagon and by the pack mule, the wagon ordinarily accompanying the field train. The pack mule is provided for the special purpose of transporting supplies needed in battle, as it may often be impracticable to follow along with a heavy

field wagon which will probably only be on hand at the conclusion of the engagement or after nightfall, when the aid station is established on or near the field of losses. While only a very limited supply can be carried on one animal, it is presumed that it may often be possible to send the mule back to the supply wagon or to the reserve supply train for additional material.

The regimental supplies include, in addition to various utensils and appliances, first-aid packages, antiseptic gauze, absorbent cotton, bandages, wire and wood splints, antiseptics, etc.

The regimental aid service has become of much greater importance under modern conditions of warfare, not only because it is now more difficult to approach the line of battle from far in rear, owing to the increased range of weapons, but also in view of greater good that can be accomplished by modern surgical methods of preventing infection by prompt protective dressings, which ultimately results in saving a large proportion of the trained men for further duty at the front. The experience in the Russo-Japanese War has conclusively demonstrated the efficiency of proper first-aid dressings, and it is stated upon good authority that the ultimate results were better in those cases in which it had been applied by medical officers.

It must be admitted that, unless the terrain is particularly favorable, little real surgical work can be done at or near the firing line. It is quite generally accepted that the presence of sanitary personnel at the front gives an assurance of speedy professional assistance that has a powerful effect in sustaining the morale of troops, and relieves them of the temptation to accompany wounded comrades to the rear. The history of our own wars indicate that the absence of such assurance has often had a depressing influence upon the morale of troops.

The benefits to be derived from prompt and proper wound treatment, both from a military and a surgical standpoint, are now considered to be of sufficient importance to warrant the sacrifice of some sanitary personnel, and casualties are bound to occur among them if they perform the full duty now demanded of sanitary soldiers.

It is neither desirable nor practicable to give extensive surgical treatment to wounded at or near the firing line, and the primary function of the regimental sanitary detachment is to assemble and prepare them for further transportation to the rear. The assistance given in front of the aid station is limited to the application of dressings contained in first aid packages and the material carried in hospital corps and orderly pouches. At the aid station such dressings may be readjusted or replaced if soaked through with blood, or supplemented by additional material. Compresses are applied to bleeding wounds, and occasionally it might become necessary to ligate an artery or perform some other emergency operation, as tracheotomy, etc. Fractures are immobilized with splints. Restoratives and narcotics must be given, and morphine in convenient form for hypodermic use is an essential remedy. Cases attended with symptoms of shock will be given the usual treatment. Stimulating food and drinks must also be prepared.

It is presumed that no surgical operations except those of extreme urgency will be performed at the aid station, unless the regiment is acting independently, or is cut off from communication with the dressing station or field hospital for a long period of time by accidents of terrain or other causes.

The difficulties of applying ordinary antiseptic measures in the treatment of wounds at the front can in a measure be met by adopting methods that found much favor in the Manchurian campaign. The use of an iodine solution to sterilize the skin about wounds has been highly recommended, and if bichloride gauze in small packages is furnished it makes it comparatively easy to assure reasonable antisepsis. v. Oetlingen suggests the use of a solution of mastic in chloroform which leaves an impermeable layer of gum on the skin, and prevents bacteria from spreading into the wound openings.

The regimental supplies include all that is required for ordinary emergency surgery, and the lives or limbs of patients should not unnecessarily be jeopardized for want of proper attention. It would hardly be justifiable to leave the severely wounded

subjected to the danger of infection if it were at all possible to apply an occlusive antiseptic dressing. A simple first-aid dressing safeguards a severe wound only for a limited time, especially during hot weather or in the tropics. It is, however, to be strongly insisted upon that all unnecessary handling of wounds is dangerous and no manipulation thereof should be attempted except under proper antiseptic precautions. It does not necessarily follow that the aid station is always crowded with wounded, and the surgeons should not sit with folded hands if it is at all possible to apply permanent dressings. Not only are the interests of the wounded directly conserved thereby, but the dressing stations and field hospitals would also be relieved of some of their burden.

In severe battles when the number of casualties in a regiment may run into the hundreds, it is obvious that the surgical service at the aid station must be limited to application of first aid dressings, the readjustments of dressings already applied, controlling hemorrhages, fixing fractures and the administration of restoratives and narcotics, and only the most simple methods would be used.

It is not expected that any elaborate arrangements for the care and treatment of wounds can be made at an aid station, and it may often become but little more than a place for assembling wounded. The necessity of maintaining constant contact with the regiment may demand a sudden abandonment of the station, and if too permanent arrangements are made the mobility of the institution might be seriously compromised. It is only after the lines have come to a standstill, a successful conclusion of an action, or at nightfall that the more definite establishment can be made. It is, however, usually worth while to improvise dressing or operating-tables from litters and to arrange the supplies, without entirely unpacking, so that they will be easily accessible. A water supply is always essential to the comfort of the wounded and some will also be needed for the preparation of restoratives and for antiseptic solutions. Shelter is desirable, especially in inclement weather, but some

caution must be exercised in selecting buildings for the purpose as they are apt to become targets for the enemy's artillery. Shelter may be improvised from tent flies and shelter halves. An effort should also be made to procure hay and straw for the severely wounded to lie upon. The regimental supplies also include some hospital stores, and a fire should be built, if conditions permit, for their preparation.

Under ordinary circumstances wounded are not carried farther back by the regimental detachment than the aid station, and it is necessary for the ambulance company to take them over at that point. The station should not be allowed to become overcrowded, and every opportunity should be taken to send such as are able to walk to the rear.

The classification of wounded into the various categories must begin here; the slightly wounded are to be assembled in groups and directed to the station for slightly wounded; the more severely wounded that are able to go some distance are sent to the dressing station or field hospital, and those requiring transportation are to be dressed and made comfortable until the litter bearers and ambulances can remove them. The "non-transportable wounded," abdominal injuries, severe wounds accompanied by much shock, etc., are given proper attention until they can be carefully moved on litters to the nearest field hospital.

While the sanitary detachment of the regiment must be prepared at all times to give first aid to the wounded, it does not imply that it is by any means necessary that a formal aid station is to be established at the beginning of an engagement or as soon as some casualties have occurred. It is essential that the regimental sanitary personnel should not lose contact with their unit, and a hasty establishment while troops are moving forward would probably result in a separation. The first-aid packages carried by soldiers, and the contents of the hospital corps and orderly pouches would furnish sufficient dressing material for those wounded while troops are advancing into battle. The wounded able to march would be directed to the station for slightly wounded or to a dressing station, and those that are

unable to proceed to the rear by their unaided efforts must be left in some protected place along the line of march to be picked up later by an ambulance company. Such wounded must be speedily attended, and the sanitary personnel engaged in such work must rejoin as quickly as possible. It would be inadvisable to leave attendants with them, except under extraordinary circumstances, as they would in all probability be urgently needed after the action had fully developed.

Protection from the enemy's fire is the first and most impor-

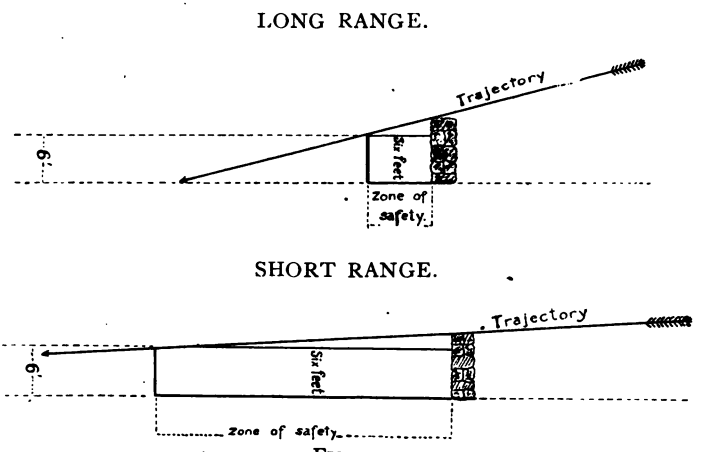

FIG. 13.

tant consideration in the selection of a location for the regimental aid station, consequently the nature of the ground and the cover afforded thereby is the determining element. Should an engagement take place on level, open country, the question of establishing an aid station would not arise until after its conclusion, or when darkness had set in. Fortunately, some good cover can usually be found, and owing to the flatness of the trajectory of the modern bullet, a moderate rise of ground, a sunken road, a gully, or other natural feature of the ground may give the necessary protection, if the place is not too far away from the enemy's firing point (Fig. 13). If the trajectory, and

especially the slope of fall of bullets is recalled, a study of a contour map would furnish a reliable guide in determining the places which may properly be considered.

Some recent writers have maintained that the location is largely determined by the wounded themselves, and that the latter naturally drift to the most convenient place, and it only remains for the regimental surgeon to bring up his supplies and the location is then fixed. However, if the ground is looked over and the map carefully studied, it might well be seen where the natural route lies for the wounded making their way to the rear, and the station established with reference thereto.

As this station must necessarily be within the danger zone, it follows that it should be as near the firing line as good cover can be found, and of two equally safe places the one nearest the front should be chosen. Should the situation and terrain permit, some of the wounded at least could be collected during the progress of the engagement, and the work of the bearers would certainly be much facilitated. The mere possibility of retreat should not deter the establishment near the line, as the wounded would be at least as well off at the aid station as lying on the field. The beneficent provisions of the Geneva Convention would certainly give them the same protection there, and in addition thereto, if disaster occurred and a number of wounded were left behind at the station, some sanitary personnel can be left with them to assure them of the necessary care and attention.

In addition to cover, it is desirable that the place should afford some conveniences, such as shelter, water, and fire-wood, which are quite necessary for the comfort of the wounded. It would also be advantageous if it were located at a point affording convenient access to the front, and to dressing stations and field hospitals in the rear, so that at the conclusion of the action ambulances could approach and remove the severely wounded, thereby saving much time and labor of the bearers.

In addition to the influence that the character of the ground has upon the selection of an aid station, the type of the engage-

ment and the tactics employed have an important bearing upon the scheme to be adopted for the rescue of the wounded.

In a planned attack the difficulties encountered in the effort to give prompt assistance to the wounded are much greater under modern conditions, as a consequence of the style of tactics now being employed. The greater range of firearms has increased the extent of the zone which has to be covered under fire, and the duration of battles has increased in like proportion. The attacking line may often be held in check for hours until sufficient impression has been made on the enemy to permit of further advance. The regimental sanitary detachment must maintain effective contact with its unit, as the line may be cut off for hours from all communication with the rear, and wounded cannot, for reasons already given, be allowed to remain unattended for many hours.

The closer the assailant gets to the enemy, the greater the probable number of casualties, and after he arrives near enough to prepare for the decisive action, it would hardly be possible except under especially favorable conditions to terrain, to cross the entire danger zone to bring prompt aid to the wounded. If it is true that about 50 per cent. of all bullets fired in severe engagements fall within a space extending from 1500 to 2500 yards from the firing point (Wolozkoi's estimate), an aid station beyond this zone might be absolutely cut off. In its efforts to remain in contact with its units, sanitary personnel is not necessarily exposed to the same extent as troops of the line. The small detachments can take advantage of the best route that the particular terrain affords and of the lulls in the firing. Should it become necessary to cross exposed ground, they must advance by rushes as other troops do.

While a definite establishment of a regimental aid station early in an attack would probably be a great mistake, it is necessary that provision should be made for those wounded in the earlier stage of the action, and a series of temporary stations may have to be established where wounded may be collected and given surgical aid. Such as are able to march would be

sent to the rear if practicable, and the remainder left to be picked up later by ambulance companies.

A formal regimental aid station cannot be established until the advance ceases, the engagement terminates, or night sets in, and then the nearer it is to the field of losses the more rapidly and effectively the wounded will be collected and treated. If it is possible to approach within a decisive range (600 or 700 yards) of the enemy's position under fair cover, it would probably not be necessary to establish until that point is reached, but this would rarely be possible. Usually the line will come to a temporary halt a number of times before the decisive point is reached, and the number of wounded on hand will compel the establishment of a station.

In a defensive action the conditions are much more simple than in an attack. The ground may be thoroughly reconnoitered and tentative locations may be selected for all the stations and evacuation routes. The personnel and supplies may be placed in readiness at or near the proposed locations, to establish as soon as the necessity arises.

The use of the field howitzer has made this service more dangerous, and the possibility of being reached by high-angle fire must be kept in mind in judging of the efficacy of cover.

The aid station in defense must also be at or near the firing line, if a rapid and efficient service is to be carried on. Behind strongly fortified positions the best location would probably be on the line itself where bombproofs, etc., may afford good cover. Some caution must, however, be exercised in fixing upon the place for a definite aid station, as it by no means follows that in the course of a defensive action, the position of the line may not be changed. A movement thereof may be necessary in order to follow the tactical movements of the enemy.

The regimental surgeons of regiments held in reserve have no means of determining where the organization may be called upon to go into action, but as they are presumably familiar with the terrain, no special difficulty will be encountered in finding the proper place when the time arrives.

The division surgeon's general plan for the care of the wounded will be known, and the aid stations may often be arranged so as to facilitate communication with the dressing stations and field hospitals during action.

In a **rencounter** it would be difficult or even impossible to lay down anything like a definite plan of action for the regimental sanitary detachment. The uncertainty of the tactical situation, and a probable lack of accurate knowledge of the terrain complicate this service very much, and it is not until the action has developed, and the further course or ultimate outcome become clear, that any definite and systematic steps can be taken for the rescue and care of the wounded. It behooves regimental surgeons to act with great caution, and special efforts must be made to maintain close contact with their respective units. After the action has developed sufficiently, they may proceed to carry on the service in a manner as suggested in the discussion concerning the aid service in attack or defensive, as may be called for by the situation.

The greater accuracy of modern artillery fire, and the massing of a large number of guns at artillery positions have brought about a change in the idea that formerly obtained concerning the location of artillery aid stations, and it is now quite generally accepted that they may be placed nearer batteries than was formerly considered practicable. The danger zone from overshots in rear of batteries is not as deep as that from infantry fire, and it is now considered advisable to endeavor to locate the station close thereto, and by preference near the inner flank which is less exposed in case the enemy attempts to envelop the position. To put it with the ammunition reserve would ordinarily be dangerous, as the enemy would endeavor to interfere with the ammunition supply whenever possible, and a station at this point might easily come within the range of exploding shell.

The aid service with *cavalry in attack* presents its peculiar difficulties, and it can hardly be compared to that with infantry or artillery. The greater mobility of cavalry troops and the

extent of ground that may be covered rarely permit the establishment of formal aid stations, and the wounded are given such attention as circumstances permit. Fortunately, the proportion of wounded is usually much smaller than with other arms of the service, and a very large percentage of those may be brought on their mounts to a proper place in rear, and no such extensive provision will have to be made for their care near the front. Severely wounded may have to be left in sheltered places along the route, in the hope that they may be picked up by an ambulance company.

When large bodies of mounted cavalry are employed in attack, the sanitary personnel must be held back, as no good purpose can be accomplished by accompanying a mounted command into action. An extensive aid service cannot be initiated until the conclusion of a successful engagement, when stations may be established at the most convenient places on the field of losses. *After defeat*, the question of sending out sanitary personnel under the protection of the Red Cross flag may arise. There is no doubt that the wounded would receive more satisfactory care from their own comrades than at the hands of the enemy, as the latter will probably be fully occupied with his own.

But little can be laid down regarding the aid service with smaller bodies of cavalry in skirmishes incidental to the service of security and information. No extensive aid can be rendered, as the surgical supplies will probably be limited to those carried by the individuals of the sanitary detachment. The details of such service must be worked out at the time and place. First-aid dressings must be applied, and every effort made to transport the wounded to the rear.

Owing to the relatively small number of sanitary troops allowed a regiment, and the large proportion of casualties that may be expected in any severe engagement, it is very important that the labor of rendering first aid and collecting the wounded *should begin as early as possible.* The amount of labor involved will be so great that the authorized medical department personnel

can hardly hope to clear the field within a reasonable time without help from other sources.

It must not be forgotten that if the enemy is driven off the field, many of his severely wounded will also have to be cared for, although it is presumed that when regular aid and dressing stations are captured, the medical officers on duty there will continue their work, and will not be allowed to depart until it had been completed.

After a successful engagement, the field would have to be thoroughly gone over by the sanitary detachment, assisted perhaps by detachments from the regiment, to discover and bring in severely wounded that may have hidden away during the action. The search of the field may often have to be carried on after nightfall, and lanterns or other means of illumination will have to be used. Unless the enemy has withdrawn, lights may draw his fire, a circumstance which occasionally happened in the war in Manchuria.

No time must be lost, as the sanitary detachment may have to follow its regiment in case a pursuit is inaugurated, or if a renewal of the engagement is in immediate prospect. As indicated above, the ground may be of such a nature as to preclude any systematic rescue of wounded during the progress of the action. Should the enemy he defeated and withdraw, the aid station would be established at the most convenient place on the field of greatest losses, where the wounded can be easily assembled for evacuation by the ambulance companies. In a short, sharp engagement with many casualties, the same course is indicated.

A sudden retreat would demand a hurried breaking up of the station, all wounded able to march would be directed to some designated place in rear, and the severe cases for which there was no transportation would have to be left behind with the necessary attendants and supplies.

After the field has been cleared and all wounded turned over to the ambulance companies, the regimental surgeon must at once take the necessary steps to renew the supplies from the

reserve supply train, and prepare to resume his place with his regiment.

In addition to the wounded, an unusually large daily increment of sick may be expected, that will have to be treated and provided for before the labors of the day are concluded.

Casualty returns and complete reports of the service performed will have to be submitted as soon as practicable.

CHAPTER VII.

DRESSING STATIONS.

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Dressing stations are established, upon the order of the division surgeon or director of ambulance companies, by the ambulance companies, which, in addition are charged with the duty of transporting wounded from the regimental aid stations and, when practicable, from the field, to the dressing stations and field hospitals by means of litters, ambulances, travois, and improvised transportation.

As noted in the chapter on Organization, the ambulance company comprises five officers, two sergeants first-class, seven sergeants, and seventy privates. The transportation belonging thereto includes twelve ambulances, three field wagons, four pack mules, and four travois. Regulations only fix the personnel assigned to conduct the transportation, one officer, two non-commissioned officers, and twenty privates, including fifteen drivers, the horseshoer, saddler, cook, and two musicians. The remaining officers, non-commissioned officers, and men constitute the dressing-station party and litter bearers. Is is presumed that three detachments of about five litter squads, each under a non-commissioned officer, are available as litter bearers. It is not, however, considered practicable definitely to assign each and every man to some particular duty, as that can best be done at the time and place by the commanding officer.

The preparation of evacuation routes from aid stations at the front to the field hospitals in rear, constitutes one of the important functions of the ambulance companies. While line troops are engaged in preparing and strengthening their position, ambulance companies should not remain idle but take advantage of the opportunity to improve the evacuation routes by mending roads, cutting away brush and [illegible]king down fences and

walls, and, perhaps, even throwing up light earth-works to protect stations and bearer routes that would otherwise be exposed to the enemy's fire. Furthermore, the routes selected should be plainly marked by Red Cross guidons, or if an insufficient number is on hand, pieces of bandage may be tied on trees, fences etc., sufficient to indicate clearly the safe road to the rear. This scheme has been used in maneuvers with great advantage, and prevented the aimless wandering over the field of ambulance company patrols and hypothetical wounded.

It cannot be expected that the limited force of the ambulance companies will be able fully to meet the emergencies of a severe battle attended with many casualties, and the chief surgeon must be prepared to augment it by details from sanitary detachments of organizations not actively participating, and possibly from field hospitals that are awaiting establishment.

Regulations provide that one medical officer may be detached from each regiment for service at the dressing stations or field hospitals. In long drawn-out battles, additional help may have to be brought up from the line of communications for temporary duty until the evacuation service is well under way.

It will be noted that, in the interest of simplicity, a formal ambulance station has been done way with in the new organization. This by no means implies that ambulances will not be expected to work as far to the front as the enemy's fire will permit.

The maximum capacity per trip of the ambulance company transportation, when working in connection with an established dressing station and using the twelve ambulances, sixteen litter squads, and four travois, would not exceed sixty-eight recumbent patients. Should the ambulances be loaded with wounded able to sit up, the number would be increased to 128, including twenty recumbent cases on litters and the travois.

The dressing stations constitute the second line of assistance, serve as points of assembly for wounded, and afford much better facilities for the surgical treatment of wounded than aid stations. They are also the first places in rear of the line where a regular

classification of patients, so necessary to a systematic service, can be properly carried out. A firm and rigorous policy must be adopted when large numbers are being received so that the transportation will only be used for those that absolutely require it. Patients able to walk to the advance depot must be directed to the station for slightly wounded and not to the field hospitals, as the latter may not suffice for the severe cases.

The omission of the dressing station and the assignment of its personnel to the regimental service has been advocated on purely theoretical grounds, but recent experience in Manchuria seems to indicate that, owing to the depth of the danger zone, this station is even more necessary than formerly. Its omission might possibly be considered in a compaign carried on in a region that is covered by a network of available railways and with greater transportation facilities than it has ever been possible to get in any of the wars of the past. Patients could then be speedily transferred from aid stations to hospital trains for transportation to semi-permanent or permanent hospitals on the line of communications, or in the home country.

Many attempts have been made to formulate definite rules for the surgical service at dressing stations, but the fact remains that the character and extent of the professional attention to be given depends very largely upon the number of cases requiring treatment at the time and place.

After severe engagements attended by numerous casualties, the interests of the individual will have to be sacrificed to some extent to the necessity of giving all wounded some attention on the battle-field. Should the situation permit and the force at work be sufficient, every wounded man should receive a permanent occlusive antiseptic dressing, all hemorrhage checked, fractures cleaned and immobilized, and, in addition, cases requiring urgent operations, such as ligation of bleeding vessels, tracheotomy, etc., etc., must be attended to in the operating department.

Operations are now less frequently called for than formerly owing to the character of [illegible]ered by modern

projectiles, and the use of antiseptic methods of wound treatment.

Many classes of wounds that in pre-antiseptic days required immediate active surgical interference to save life or limb, can now safely be held over until patients can be given the benefit of all the conveniences that a hospital affords, without incurring any special risk.

A record such as made in 1862 at Fredericksburg, for instance, which shows that 11 per cent. of all the wounded were almost immediately operated upon, will never be duplicated in modern times. Operations at the dressing stations will be strictly limited to emergency surgery, and it is believed that less than 1 per cent. of the wounded would need such attention.

No arguments need be advanced to show the advantages that are to be derived from permanent antiseptic dressings, and no efforts should be spared to accomplish this result. Not only does it give protection against secondary infection, but patients so treated can be more easily transported, thus facilitating the most difficult problem that confronts the sanitary department in the field.

Our organization provides four complete and distinct dressing-station parties to cover the line of battle of a division, which normally extends from 3000 to 5000 yards, depending upon the character of the ground, and whether troops are employed in attack or defense. It is customary to allow about three men to the yard in defense and five in attack; that is to say, about that number are necessary to give a reasonable assurance that one man per yard may be put on the firing line for the decisive conflict. This estimate of the number of men required includes supports and reserves.

Peculiarities of terrain and unexpected movements of the line may leave the dressing stations inaccessible from parts thereof, but an organization such as ours obviates some of the difficulties of breaking up and moving a station, and permits of greater elasticity of the system of relief, and the division surgeon may exercise discretion in ordering the establishment of the companies.

It is usually considered inadvisable to maintain a special

reserve of sanitary organizations, and it is held that all should be put in service as soon as any occasion therefore arises.

The number of separate stations that are to be established for the division line depends very much upon the terrain. The consensus of opinion seems to be in favor of combining dressing-station parties, or even uniting aid and dressing stations whenever feasible, as greater and better results may be expected from a concentration of forces.

The organization and internal administration of dressing stations is sufficiently set forth in the Manual for the Medical Department. All the transportation of the company is considered available for bringing up the necessary supplies required at the station.

In mountainous or other difficult terrain, the means of transport for battle supplies may be limited to the four pack mules. While the amount carried by the four animals would prove inadequate for even a moderate number of casualties, it is to be presumed that the transportation would be sent back to the wagons or the reserve supply train for the additional material needed.

The place to be selected for the station should be large enough to admit of an orderly arrangement of the different departments, otherwise confusion would result that would seriously interfere with a systematic and rapid service.

Some shelter is necessary, not only for the dressing and operating departments, but also for the wounded awaiting attention, and for those who have received treatment and are awaiting transportation to the rear.

The tentage ordinarily carried by the ambulance company would not be more than sufficient for the first-named purpose, and, unless buildings are at hand, efforts must be made to improvise shelter against the elements by the use of shelter halves, blankets, etc.

Some time may elapse before field hospitals can be established and the transport service set in motion, and in inclement weather some such provision is quite essential.

Water and fuel must be procured and a kitchen established, so that stimulating foods can be prepared and water sterilized for surgical purposes.

The dressing station and the roads leading thereto must be conspicuously marked so that they may be seen at some distance. Red Cross flags and green lanterns are used for the purpose.

It is essential that the place selected should be well protected from the enemy's fire and advantage must be taken of irregularities of ground and the cover afforded by substantial buildings, etc. A comprehensive knowledge of the range, trajectory, and penetration of projectiles is necessary properly to estimate the qualifications of a proposed site. The chief surgeon and the director of ambulance companies must also have a practical knowledge of map reading in case it is impracticable to reconnoiter the ground.

The question of convenience of access from front and rear is also of great moment, and if possible the station should be placed on or near a well-marked and well-known route leading to the rear. At the same time it must not be so placed as to occasion any obstruction to troops moving to the front or to the ammunition supply service, nor should a place be selected that is likely to become of tactical importance. It would be unwise, however, to establish in a deep ravine or gully, which, although it may afford ample protection against fire, would be so difficult of approach as to make the transportation of wounded to and from the station almost impracticable.

It must not be thought that the selection of a site and the establishment of a dressing-station is always an easy problem. In a series of rapid and decisive conflicts attended with heavy casualties, the capability of the medical department will be strained to the utmost limit. Even under the most favorable conditions of terrain, improper locations may entail many additional difficulties, both in the transportation of patients and in their care and treatment.

Inclement weather, heavy roads, etc., all conspire to make the work one of great difficulty, and ambulance companies may

have to labor night and day, with only short intervals of rest. If, in addition, badly located dressing stations complicate the situation, the medical department may easily be overwhelmed.

Greater caution must be exercised in the establishment of the dressing station than in the case of aid stations, on account of the relative lack of mobility of the former. After the stream of wounded is once directed to a certain location some time is required before it can be diverted to another place, neither can the supplies all be packed until all the wounded that may have arrived have been attended and prepared for transportation to the rear.

It would be unwise to omit the establishment of this station on account of a mere possibility of retreat. On the other hand, it would probably be a mistake to attempt a definite establishment behind a position that could not be held if vigorously assaulted; not so much on account of the liability of the wounded falling into the hands of the enemy, but of the probability of their becoming exposed to his fire in the pursuit.

The same general principles mentioned in the discussion concerning the location of aid stations apply to the selection of the site for the dressing station, but better cover and more space is necessary, as the number of cases to be treated there will be very much larger than at any one of the aid stations.

It was formerly customary also to indicate the proper location of the dressing station by directing that it should be put a certain number of yards in the rear of the line of battle or of the reserves, the point being always well beyond the range of the firearms then in use. Under modern conditions an effort would be made to establish somewhere within the danger zone from overshots, if proper cover can be found.

To put the dressing station far away from the line of aid stations would not only enormously increase the labor of the bearers, but would also defeat the object of speedily assembling the wounded and giving them the better surgical care afforded at the station. Some authorities contend that the dressing station should not be much farther away than

the regimental stations, and that much would be gained if it were near enough to combine with it one or more of the aid stations.

From all that has been said it may be concluded that the dressing station should be as near the line as the character of the cover afforded by the terrain permits, and of two equally well protected and otherwise convenient places, the one nearer the front should be chosen. Always with the proviso, however, that the special tactical situation, as observed by the division surgeon, or communicated to him by the commander, will permit of its being done with reasonable safety. It must not be so close as to render it liable to be involved in ordinary fluctuations of the line of battle.

Much would be gained if the location were easily accessible and afforded good cover from the enemy's fire. It is quite plain that the further the dressing station is to the rear, the greater would be the probability of interference with the work of the bearers by fire-swept zones.

It has been seriously proposed that a provision should be incorporated in regulations directing that dressing stations should not be established until after the decisive combat had taken place. Such a course might easily be followed in a short engagement lasting only a few hours. It has been shown, however, that modern combats are likely to extend over a period of several days, and as lulls and pauses occur from time to time, the wounded will make their way to the rear and the necessity for the dressing station at once arises. Even during the active combat wounded will avail themselves of covered ways to proceed to the rear. If the straggling of wounded over the field is to be prevented, provision must be made for assembling them, and the ambulance companies must be prepared to collect them and give them the needful attention.

The type of the engagement and the kind of tactics must be taken into account in formulating a plan for the use of sanitary companies and the establishment of dressing stations.

Great difficulties may arise in an attack in connection with

this service. The lack of accurate knowledge of the terrain, the constant tendency of the line to advance, and the varying phases of the tactical situation give rise to much uncertainty.

Much ground may have to be traversed under fire before the advancing line comes within effective range of the enemy, and ambulance companies may have much difficulty in keeping within reach of the troops which they are expected to serve. They must push as far to the front as the enemy's fire and the tactical situation permit, but not so close as to run the risk of being involved in the fluctuations of the line of battle. The terrain may often offer sufficient cover so that the ambulance companies may come up to within a reasonable distance, and there await a proper opportunity to establish.

The urgent necessity for dressing stations will probably not arise until the troops have arrived within effective range, and then the zone of overshots will be so well covered by flying projectiles that an advance over exposed ground will be utterly impracticable, and the companies may have to wait for a lull or until the tide of battle temporarily shifts to some other parts of the field. The time lost under such conditions can easily be made up if the stations can finally be put near the aid stations and the field of losses.

When many casualties have occurred, dressing stations must be established if it is at all practicable. The division surgeon must not act with too great caution for fear of retreat or unexpected movements, neither should he allow himself to be misled by the experience obtained at maneuvers, where tactical procedures that might require hours for their accomplishment in actual engagements are often carried out in a few minutes.

It is, however, considered to be a great mistake to establish early in an attack, as the station would soon be left so far in rear as to preclude an effective service. It is also said to be inadvisable to fix the site of dressing stations in battle orders, but with four dressing-station parties per division, it might be of advantage to fix the location [illegible] orders that insure the greatest publi[illegible]

wounded able to walk. Some of these will endeavor to make their way out of the danger zone, and a conspicuously located dressing station would do much to prevent promiscuous straggling of wounded. As soon as the other companies have definitely established near the field of losses, most of the personnel of the first station may be withdrawn to reinforce them.

The selection of definite locations during the progress of the engagement requires a keen insight into the military situation on the part of the division surgeon. He must keep himself thoroughly informed of all the tactical movements of troops, and use his ambulance companies accordingly.

Whenever two or more ambulance companies establish dressing stations for a battle line, the chief surgeon, or director of ambulance companies, must assign each company a well defined sector of the line.

The largest number of casualties are to be expected on that part of the field where the attempt is to be made to break the enemy's line, and special provision must be made there for large numbers of wounded. Ordinarily it would seem advisable to await definite establishment of dressing stations until the line had come to a standstill and the number of casualties justified it.

It may happen, as it often occurred in Manchuria, that no definite steps can be taken to establish near the line until late in the day or after nightfall, but if they are then put at the aid stations or on the field of losses, the wounded can be assembled there without loss of time in transportation and given the necessary attention.

Stations should not be placed on the exposed flanks, for while such stations may be safe from frontal fire, they would be involved should the enemy make a flank attack.

As in the case of aid stations, the establishment of dressing stations in a **defensive engagement** presents less difficulty than in the attack, and a systematic service is more easily inaugurated. More orderly arrangements can be made in advance for the evacuation of the wounded, and the transport service on the line of communications is usually prepared to take over the

wounded sooner, thus relieving the organizations at the front. The ground being well known, tentative locations of stations and evacuation routes can be selected in advance, and definite instructions concerning many of the details of the service can be given by the division surgeon.

Sanitary units can be held in readiness near the places tentatively chosen as sites of the stations, to establish as soon as the number of wounded justify it. Supplies can be brought up and distributed where most needed.

There is, however, some uncertainty about the situation which renders it advisable that the division surgeon exercise some caution in giving final orders for the establishment of dressing stations, as it cannot be definitely foreseen where the enemy will make his strongest effort, and when and where the brunt of the engagement will fall. A careful division surgeon will therefore await developments before he makes his definite arrangements. It is clear that the greatest casualties must be expected at the point where the enemy attempts to break the line, or on the flank where he endeavors to make an enveloping movement.

A reserve of sanitary troops must be maintained to be put into service only when the reserves are thrown into action, as when the enemy makes his decisive attack.

The stations must not be too near the line where the decisive action is fought, as the enemy will concentrate his artillery fire thereon, and it would be difficult to find good cover, especially if howitzers are being used. Furthermore, it must not be so near as to become easily involved in slight fluctuations of the defensive line.

Nothing definite can be laid down concerning the establishment of dressing stations in a **rencounter,** the situation being much more uncertain than in other types of engagements, behooving the chief surgeon to await developments before taking any active steps in establishing dressing stations. Usually the divisional sanitary units are so far in rear that the situation will have cleared before the ambulance companies can be brought

within reach. They are then used as in attack or defense, according to the tactics employed by the troops they are serving.

The final arrangements for the care of the wounded on the battlefield will have to be more elaborate, as it cannot be expected that the evacuation service could be initiated as speedily as in connection with a planned battle. Field hospitals that have been marching with the trains will arrive late, and wounded will have to be sheltered and cared for at the dressing stations for hours.

Ambulance companies serving with cavalry commands have an entirely different problem, unless with cavalry fighting on foot, when the same principles apply as in infantry. A regular establishment of a dressing station would be required only after a victory and the enemy driven off the field, when it must be put at the most convenient place on the field of losses.

In case of retreat the wounded that cannot be carried away from the dressing station are left with sufficient personnel and supplies. The transportation is hurried to the rear and carries away the supplies and as many wounded as possible. The transportation and extra supplies must not be allowed to fall into the enemy's hands. Humanity demands that sufficient personnel and matériel be left for the care and comfort of the wounded. Not only the absolutely essential, but everything that is necessary for their comfort should remain with them. War costs millions and the expense of a dressing-station outfit is of no consequence. The sanitary organizations of troops that have been compelled to retire may soon be resupplied under modern conditions, and the captured personnel will be allowed to rejoin their units in due time. The idea that the wounded left behind will be well cared for by the enemy, and that actual and complete neutrality really exists among those engaged in each other's destruction, is an idle dream of the humanitarian. At a time when both friend and enemy need help, the comrade will first be looked after, and it is too much to expect that the enemy's wounded will receive the prompt attention that their wounds require.

CHAPTER VIII.

FIELD HOSPITALS.

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In our service only four field hospitals with a normal capacity for 108 patients each are allowed a division, although in foreign services the usually accepted standard is six hospitals of 200 beds each. It is therefore of special importance that the greatest prudence be exercised in their use, as their capacity is so much below the requirements for the wounded of a division after an engagement attended with only a moderate percentage of losses. A cavalry division is allowed two, and an auxilliary division, one field hospital, with the same personnel and equipment as those of an infantry division.

When an engagement is at hand the division surgeon must always be prepared greatly to enlarge the capacity of these institutions as soon as they are established, by drawing upon the extra supplies carried in the reserve supply train and upon local resources. The need of such preparation is apparent when it is considered that if a division sustains an ordinary 10 per cent. casualty, each field hospital may be expected to shelter temporarily and care for at least 300 wounded, to say nothing of an extra large daily increment of sick.

The regulation field hospital organization comprises five medical officers, three sergeants first-class, six sergeants, forty-eight privates, the necessary equipment, including 21 hospital tents and eight four-mule wagons.

It will be observed that our field hospitals are better equipped than those of most foreign services in that enough tentage is carried to shelter comfortably 108 patients, in addition to that required for the operating-room, dispensary, kitchen, etc. By using the tent flies, additional shelter may be improvised so as to increase the capacity to 162 beds. The hospital is also provided with sufficient bed sacks for that number.

The practical result of this more elaborate equipment is that field hospitals must not necessarily be established in villages or towns. A large farm house with good barns would probably offer the required shelter even though the institution had to be very largely expanded. The choice of locations is therefore not so limited, and a great advantage may be derived therefrom, especially in sparsely settled regions, and the first transport problem may often be much simplified by the establishment of the hospitals at the most convenient places.

The indiscriminate use of these institutions for the care of the sick on the march or in camp, which immobilize them for the time being, might be followed by serious consequences in case of an unexpected engagement. The already insufficient provision for the seriously wounded would be further reduced and the suffering of those meriting the greatest consideration would be needlessly increased.

It must be strongly insisted upon that these units are primarily for the use of wounded, and to divert them to other purposes, except in case of great emergency, is liable to cause the most serious embarrassment. Emergencies may arise, however, that require them to be used temporarily for the shelter of the sick, but such use should be exceptional and only when the service of the line of communications is interrupted or inadequate, or when there is no possibility of contact with the enemy. There is no objection to the use of the personnel of these hospitals in connection with collecting stations for sick or in established hospitals in the vicinity, when there is no immediate prospect of an engagement.

In battle, field hospitals may also be used temporarily as dressing stations in case of emergency when the ambulance companies are fully engaged, and a proper opportunity presents itself. Under such circumstances they need not be established as hospitals until the tactical situation permits of its being done with reasonable safety. The use of field hospitals for such purposes might seem to be of great advantage to the wounded as it would save them an additional move, but a general use of these organi-

zations for the establishment of dressing stations cannot be relied upon, as the trains of a division or field army must ordinarily be kept so far away from the zone of actual conflict. It is only under most exceptional circumstances, as for instance in a planned defense, that they could be brought on the ground early enough to render effective service as dressing stations. Field hospitals are too slow and unwieldly to be expected to maintain the close contact that is required of ambulance companies, in order to give speedy care and attention to the wounded. Opportunities may occur in planned battles when they may perform the dual function of dressing stations and field hospitals, and receive patients directly from aid stations and from the field.

In severe engagements when dressing stations are liable to be overwhelmed by large numbers of wounded, some of the personnel of field hospitals that have not been established may be hurried to their assistance, to remain until their respective institutions are opened, when they must return with the first convoy of wounded directed to them.

Field hospitals held in readiness near the field may also serve a useful purpose by improvising dressing stations to render assistance to wounded that may have straggled to the rear.

It is not intended that field hospitals should serve as permanent institutions for the care of wounded, as their stay therein must be short; only so long as it may be necessary for the chief surgeon of the line of communications to perfect his arrangements for taking them over and evacuating them to the rear, or to convert them into evacuation hospitals. In the latter case an exchange of equipment is effected and the field-hospital organizations are released again to follow the division to which they properly belong.

Field hospitals are divisional units and when established simply constitute one of the stages *en route* from front to rear for the wounded of the division. If there is any probability of another engagement, they must be speedily freed to meet the

urgent necessity of giving the wounded shelter and care that cannot be given at aid and dressing stations.

Field hospitals constitute the first place near the field of battle where the more serious surgical operations may be performed with reasonable safety, and where all wounds may receive permanent dressings. However, the facilities of these institutions are not to be compared with those of evacuation and base hospitals, and operative procedures that can be postponed until the patients can be transported to the latter-named institutions should not be attempted.

It is quite essential that field hospitals be very mobile, and their equipment must be as primitive as is consistent with the purpose for which they are provided. The necessary facilities and appliances for assuring reasonably good antiseptic surgery in an improvised operating-room, and ordinary instruments and dressings are all furnished. Bed sacks, which are to be stuffed with hay or straw, are included, and it is presumed that when hospitals are established in towns, additional bedding and appliances may be collected.

Every wounded man admitted must receive at least a permanent occlusive dressing, if such has not already been applied at the dressing station. Fractures must be cleaned and immobilized so that patients may safely stand transportation to a distance with minimum danger and discomfort. Patients with penetrating abdominal wounds will rarely require operation in field hospitals. Experience in recent wars has quite conclusively demonstrated that fully as large if not a larger percentage of such cases recover under expectant treatment. The facilities necessary for such operations are found in these hospitals for the exceptional case requiring them. Amputation of a crushed limb may occasionally have to be made, and other emergency operations performed.

It must be recognized that the primary function of field hospitals is to afford speedy shelter and primitive hospital care for the wounded, and, as at aid and dressing stations, the ...nts are prepared for further transportation. The facilities

for such work are much better than at the other stations and, what is more important, more time and care may be taken to accomplish the desired result.

Should it be impracticable speedily to evacuate these hospitals or turn them over to the line of communications, additional personnel would have to be drawn in from the division or from the service of the rear, and an opportunity would be afforded a large number of medical officers to do strictly professional duty. Such service is much desired by all earnest medical officers and every opportunity should be given them.

When troops are marching into action, the trains are usually kept far in rear so as to be secure in case of reverse; field hospitals therefore should not be attached to field or other trains. It would not be advisable to bring these heavy organizations up close as long as the situation remains uncertain, as they might easily be involved in fluctuations of the line, or at least might prove an obstruction on roads used for troops and ammunition. The more mobile ambulance companies may have an opportunity to accomplish a great deal before it becomes practicable to bring field hospitals within reach.

It would by no means always be necessary to depend upon the tentage carried by field hospitals for shelter for the wounded, as buildings in a town or village would be preferable, and the probability of good communication to front and rear would be greater than in the field. The shelter and opportunity for collecting additional beds, utensils, etc., afforded by a town would also be of value.

While a town will afford many conveniences for the establishment of hospitals by the use of buildings for operating-rooms, wards, offices, etc., and the probability of finding a convenient water supply, fuel, and straw, there is always a possibility of a conflagration which makes it advisable to avoid closely built up districts.

Access to a railroad or navigable stream would aid immensely in the subsequent evacuation of the hospitals. It would be a mistake to put them, except perhaps for wounded who cannot

stand transportation, anywhere else than at a place that gave such facilities, if such a point was within convenient reach. Easy access from the front is not the only requirement that must be met. If the military situation permits, it is of decided advantage to locate field hospitals near dressing stations for the accommodation of the seriously injured that cannot stand transportation.

Recent war experience has clearly demonstrated the injurious effects of transportation on patients who have penetrating abdominal wounds and other dangerous injuries accompanied by much shock, and that better results can be obtained by treating such cases at or near the locality where the injuries occurred. Furthermore, it is hardly consistent with humane ideas to subject wounded with the mark of death on their brow to the painful process of transportation to a distance, simply to assure them of safer shelter for the few remaining hours they may have to live.

A greater distance from the front is permissible for the location of field hospitals than for dressing stations, but it must be considered that the further they are away from the dressing stations, the greater will be the labor required for the transfer of wounded, and the longer time it will require to get them under shelter. The possibility of a retreat should not prevent their being placed within a convenient distance, and only the danger of being involved in the ordinary fluctuations of the line and being subjected to the enemy's fire make it advisable to act with caution.

Field hospitals should be as near dressing stations as the military situation permits. If conditions are such that they cannot be established until the conclusion of an engagement, there would be nothing to prevent them being placed close to the dressing station, if a suitable location can be found.

The selection of a site for field hospitals presents fewer difficulties than in the case of the other stations, for the reason that they may be placed entirely beyond the danger zone from overshots, and still be able to fulfill their proper function. Usually they will be so far in rear of the troops going into action

that by the time they can be brought up, the situation will have cleared to some extent at least, and a reasonably safe place can easily be found.

In deciding upon the location of field hospitals, the probable number of wounded that are to be cared for, the proximity of the evacuation hospitals, and the transport facilities will all have to be taken into account. If a stubborn fight is anticipated, a large number of wounded may be expected, and the field hospitals will have to be largely expanded, which would suggest locations near buildings that offered the necessary facilities. If evacuation hospitals are at a distance and cannot be advanced within a reasonable time, and if the transport service cannot be set in motion at once, the question of shelter, convenience of getting supplies, and local sanitary conditions become more prominent. The resources afforded by a town or village would then be of special advantage.

Protection against enemy's fire must be assured either by placing the hospitals well beyond the range of fire, or behind natural obstructions that give safe cover. A field hospital once definitely established is practically immobile, and no such risks can be taken in locating them as in the case of the lighter organizations. The division surgeon must act with caution when he proposes to establish them anywhere near the scene of conflict, and would hardly be justified in putting them well up to the front unless a successful outcome was apparent, and the terrain was particularly favorable. He must not let his desire to save time in getting the wounded under shelter lead him astray, and go so far to the front as to expose the hospitals to the danger of the enemy's fire. Efficient work cannot be done if the safety of the wounded and the hospital personnel is constantly threatened.

After a victorious engagement and the enemy is driven from the field, the hospitals that have not already been established should be located at the most convenient points near the dressing stations and the field of losses, paying due regard to evacuation facilities.

As far as the type of engagement is concerned, the same general

principles laid down in connection with the location of other stations also apply in the case of field hospitals. While it is desirable, for reasons set forth above, that field hospitals should be as near dressing stations as possible, they must not be placed so near as to be endangered by fluctuations of the line of battle.

In planned defense, safe places can be tentatively selected beforehand and the hospitals held in readiness there or as close as practicable, to establish as soon as the necessity arises. Additional supplies can be collected and buildings prepared for the reception of wounded. Places can be chosen that are on convenient evacuation routes, and preliminary arrangements for sending wounded to the rear can be made with the chief surgeon of the line of communications.

In an **attack,** the hospitals have to be kept far in rear and cannot be brought up until perhaps the further course or ultimate outcome of the engagement becomes clear, and the hospitals can be placed within convenient reach of the dressing stations.

In a **rencounter,** the uncertainty of the situation during the development of the action renders it advisable to hold them back until it is clear what part the division is to play, and then the necessary steps can be taken to adapt this service to the situation as outlined above.

As there will always be more or less uncertainty in all types of engagements as to the ultimate course and outcome, it is only an ordinary precaution to delay the definite elaborate establishment of field hospitals until the conclusion, and until that time only provisional institutions should be opened, so that if a radical change in the military situation takes place too much time will not be lost if it becomes necessary to move.

If a retreat is ordered, efforts will be made to send as many wounded as possible to the rear, and the remainder left with sufficient personnel and supplies.

CHAPTER IX.

STATION FOR SLIGHTLY WOUNDED.

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Stations for slightly wounded are established, usually one for each division, which serve as assembly points for such cases as do not require immediate hospital care and shelter and are able to march some distance.

This station constitutes a new feature as far as our service is concerned. The necessity for some additional provision for the care of wounded in the collecting zone is apparent when the small number and limited capacity of field hospitals is considered. These places are expected not only to facilitate the rapid collection and removal of a troublesome class of wounded from the front, but also to have some influence in limiting straggling in rear of the line by fixing a definite place where slight cases are to be assembled. "Skulking and straggling" will be discouraged by systematic provision for the slightly ill or injured, where all who should be excused from duty may obtain proper authorization.

No permanent personnel or matériel is provided in regulations for this station, but it remains for the division surgeon to detail in each case, medical officers and men from trains or from other organizations that will presumably not be actively engaged. A large force will not be needed as most of the wounded arriving there will have received at least a first-aid dressing at the aid or dressing stations. One medical officer and eight or ten men will probably prove ample for this service. The necessary food and surgical supplies are to be obtained from the reserve supply of the train.

This station is primarily intended to relieve field hospitals and dressing stations of the slighter cases, and to serve as an intermediate station for such on their way to hospitals on the line of communications. It may also serve for the reception of sick and exhausted who are unable to continue at the front, and who

after rest and refreshment may proceed to the rear. It is especially important that this class of patients be kept away from field hospitals as they would be the first to arrive, and, in severe engagements, would fill them to overflowing before the severe cases could be brought in.

No surgical service of any consequence is expected to be performed there, and no elaborate arrangements need be made. Some dressings may have to be replaced or readjusted, and possibly operations to check hemorrhage or other extremely urgent surgical procedures may have to be carried out. A detached service chest and a box of reserve dressings would suffice for the purpose.

A systematic service must be assured by arranging a receiving and dressing section where wounded may be recorded, and where those who have not passed through the hands of medical officers at the front may be dressed and given diagnosis tags, which may be considered as proper passports to the rear. A very important duty to be performed is the sorting of cases. Malingerers, and slight cases that are deemed able to continue at the front in spite of minor illness or injury, are to be sent back to their organizations. Patients with severe injuries who have inadvertently arrived there must be sent to the nearest field hospital.

A kitchen must be improvised so that food may be given to all. Rations and hospital stores may be obtained from the supply train. Some shelter for wounded is also necessary, especially in inclement weather, and it will usually be possible to find a building or a group of buildings for the purpose. Shelter is of greater importance after engagements that continue until late in the day, or after nightfall, when patients may have to be retained until next morning.

As soon as patients have received the necessary surgical attention and refreshments, they will be turned over to the forwarding section, and those who have been marked "duty" will be sent, after a rest, to their units. Those who are to be sent to the rear will be organized into detachments under a sanitary

soldier or the senior among the wounded, and directed to the advance depot or other designated place where arrangements for their reception will be made by the chief surgeon of the line of communications. Each detachment thus sent must have specific directions as to the route to be followed and the destination, also instructions must be given as to the course to be pursued should any member of the detachment become unable to continue the march.

When detachments are sent to the rear it would be advisable to send some wheeled transportation along with them, whenever such can be obtained in the vicinity, to carry the men's packs and those who may become unable to continue the march. Empty supply wagons or vehicles picked up in the neighborhood may be used for the purpose. Should it be impossible to procure wagons, such patients may have to be left in houses along the route, and the line of communication authorities notified.

The selection of a location and the determination of the time for establishment can usually be made before the engagement begins and published in the division battle orders. It is of special importance that the whole command should be accurately informed of its whereabouts, so that slight cases occurring early in the engagement may soon find their way there, thus preventing the straggling referred to above. Medical officers and members of the hospital corps especially, must be ready to give specific directions for finding the station, and give information concerning the routes thereto.

As soon as troops form for battle the designated personnel and the supplies must be assembled there, and the place prepared for the reception of wounded. If the assembly place for the sick of the command is chosen for the purpose, it will only be necessary to bring up the extra supplies. Even in a rencounter there would probably be sufficient time to make all preparations before any wounded could arrive. Slightly wounded arriving at a dressing station or field hospital must at once be transferred, and these institutions will be relieved of an encumbrance and

all attention can be given the more serious cases. When the time comes to break up, the slighter cases will all have been disposed of, and the entire energies of the sanitary personnel can be devoted to those who require the most attention.

The question of distance from the field of losses is not of such importance as in the case of other stations, except, perhaps, in the case of an action that takes place late in the day or at night when the difficulty of finding a distant station would have to be taken into account.

As the slightly wounded will be expected to march eventually to the advance depot or other place on the line of communications, it might seem to be a matter of indifference whether this station was one or ten miles away from the line of battle, but as a matter of fact it must be placed within convenient reach of the field of losses—just beyond the danger zone. The danger of being involved in wider fluctuations of the line is very small as it can be broken up at a moment's notice and moved out of the way.

The place selected must, if possible, be at some point well known to the troops, and generally on the route passed over by them, as slightly wounded men naturally drift back the way they came. A site near some prominent land mark that can be seen at a distance, a town or village or crossroads through which troops have marched, is taken by preference.

The station should also be at some distance from field hospitals to prevent as much as possible, the slightly wounded from making demands upon the conveniences of these institutions. It will perhaps be found easier to prevent them from going there than to turn them out after arrival. It is also quite desirable that the place selected should be easily approachable from the front and on a convenient evacuation route to the rear. It is usually recommended that it should not be located on the main line of retreat for fear of obstructing the movements of advancing troops or ammunition columns, but it must be borne in mind that such route is perhaps the best known and most readily followed. For similar reasons it is often stated that the main route should not be designated for the subsequent evacuation of the station

and that some parallel road should be chosen, but the same objections apply as in the case of the site of the station.

It is quite safe to estimate that only about 15 per cent. of the wounded will be able to march some distance to the rear. Based upon this estimate, from 200 to 500 or more slightly wounded may be expected after severe engagements, sufficient to fill from one-half to the entire normal capacity of the field hospitals of the division. The wisdom of making some additional provision for this class of cases would seem to be abundantly justified.

CHAPTER X.

LINE OF COMMUNICATIONS.

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The very intimate relations which exist between the sanitary service of the lines of communication—the evacuating zone—and that of the front or collecting zone, make it necessary that a brief sketch of the organization and function of the line of communication service should be given in connection with the discussion of the service in the collecting zone.

The lines of communication are embraced in the territory immediately in rear of the zone of operations. This territory is divided into a number of districts corresponding to the number of field armies composing the force at the front.

Each field army, as a rule, maintains its own line of communications within the district assigned to it, even if several are united to form an *army*.

The lines of communication may consist either of railway or water service or of both. In the absence of these, wagon transportation must be utilized. They include a base where depots of supplies and hospitals are maintained, and supply or issue depots at the front.

As troops advance from the base, a line of communications is formed and its head must not be more than two days' march in rear. As the line extends, a chain of stations is established, usually at intervals of about 15 miles, if the route is on a highway. These stations are protected by troops and may serve as convenient points for storing supplies and the establishment of hospitals and other sanitary institutions.

At the head of the line of communications a temporary depot of supplies is established where division trains may obtain the stores required by their units. This advance depot may have to

be moved from time to time to conform to the movements of the army.

A regular organization is provided for the service of the line of communications, headed by a commander who is provided with the necessary troops and a staff, including a chief surgeon. The function of this organization is to keep troops at the front provided with ample supplies of all kinds that may be required, and to transport the sick and wounded who are not expected to recover within a reasonable period, to the base as rapidly as possible.

The chief surgeon, under the direction of the commander, must therefore co-operate not only with the service in the collecting zone, but also with that in rear of the base which is to relieve his institutions of non-effectives, and upon which he must rely for supplies for the sanitary units at the front and in the evacuating zone. He must, therefore, act in accordance with instructions received from both mentioned sources and meet the demands of the organizations at the front for supplies, to take over their sick and wounded, and to evacuate them beyond the base at such times and to such places as may be directed by the War Department.

As indicated above, the relations of the sanitary service at the front and of the lines of communication are so intimate that it is quite impossible to fix a line of demarcation between them, but their organizations are, however, separate and distinct.

The organizations named on page 169 are mobilized for the line of communications service in such numbers as provided by regulations or the needs of the situation may demand.

The number of each of these institutions that may be required, transport columns, evacuation and base hospitals, and supply depots excepted, cannot be fixed as it depends entirely upon the length and character of the line of communications. The personnel for those which have no definite allowance will have to be specially provided by the War Department or, perhaps, by details from the regular organizations of the line of communications, re-enforced by Red Cross columns.

Organizations and institutions	Medical officers	Sergeants 1st class	Sergeants	Privates	Dentists	Female nurses	Ambulances	Wagons	Bed capacity
Transport column	4	4	16	64	....	....	12	3	
Evacuation hospital	14	8	16	129	....	....	3	2	324
Base hospital	20	8	16	129	1	46	3	2	500
Supply depot	2	1	2	12	....	....	....	....	....
Hospital train	3	1	2	24	....	....	....	....	200
Hospital ship	5	1	4	35	....	....	....	....	200
Convalescent camp	Allowance of personnel not fixed, but is dependent upon circumstances.								
Casual camp for sanitary personnel.									
Rest station									
Contagious disease hospital									
Receiving hospital at railway station or boat landing.									
Red Cross column									

In preparation for a serious campaign, a personnel and transportation reserve should be specially provided, not only for the service on the line of communications, but also to reinforce the sanitary units with the troops at the front in case of emergency.

In every great war it has become necessary, sooner or later, largely to increase the sanitary personnel, especially that of the line of communications, and in the interest of economy and efficiency, regular provision for it should be made in our war organization. A systematic evacuation service cannot be carried

on by unorganized and untrained civilians. The confusion and lack of co-ordination incidental to such a service has always proven most unsatisfactory and very expensive, both as regards human life and treasure.

The allowance of evacuation and base hospitals is based upon the estimate that hospital provision will have to be made for about 6 per cent. of the force at the front, and two of the former and one of the latter are mobilized for each division, affording a total normal capacity for 1148 patients for a division of 20,000 men.

The chief surgeon of a line of communications serving a field army would have at his disposition at least two transport columns, four evacuation and two base hospitals, two supply depots and such other institutions and organizations as the situation may require.

It has frequently been remarked that the success of the sanitary service at the front and on the line of communications depends very largely upon the rapidity with which non-effectives can be removed from the zone of operations. It must also be admitted that efficient service in the zones mentioned does not depend so much upon the quality of the professional work of individual medical officers, as upon systematic co-operation or "team work" in the matter of sanitation, removal, and incidental care and treatment of non-effectives by the sanitary organization.

The service on the line of communications is of infinitely greater importance, from a strictly professional standpoint, than that of the front, as sooner or later all the more severe cases of sickness or injury are turned over to it for temporary or permanent care and treatment. Its primary function is, however, the removal of non-effectives from the zone of operations, where, from a military point of view they constitute a serious impediment. It must not be forgotten, however, that at least temporary care and treatment of all patients is required during the process of evacuation, and all sanitary units must be organized and equipped for this dual function.

In the efforts of the medical department to maintain the highest possible effective strength of the force at the front, *it is all-*

important that some relation should be maintained between the distance patients are to be transported, and the probable duration of their disabilities. It is desirable that the slighter cases should be held and treated as near as practicable to the zone of operations so that no unnecessary time will be lost in returning them, upon recovery, to their organizations.

If the military situation, climatic and other conditions permit, no cases except such as will probably require prolonged hospital care, and those permanently incapacitated, should be sent further to the rear than the base of operations (base hospitals).

No definite time can be fixed upon for the stay of the various classes of cases on the line of communications, as in preparation for battle or other emergencies the institutions may have to be cleared in anticipation of a large influx of sick and wounded, and much judgment and discrimination will have to be exercised in determining the extent of the evacuation process.

Transport columns are new organizations in our service and are to be mobilized at the rate of one for each division, for the purpose of connecting the front with the line of communication institutions and for service on the line itself. They must keep in touch with troops on the march, and be prepared to take over the more serious cases for transportation to the nearest railway station, boat landing or hospital. This service is performed under the direction of the chief surgeon of the line of communications upon the demand of the chief surgeon of the field army, who notifies the former whenever sick of the command are assembled for evacuation.

Field hospitals will be cleared of patients by the transport columns whenever it is impracticable to convert them into evacuation hospitals. If there is no railway station or boat landing convenient to the battle-field, it may be necessary largely to augment these columns in preparation for battle by the addition of transportation provided for the line of communication for other purposes, by Red Cross columns or by hired vehicles, as these units are only strong enough to meet the very ordinary emergencies. They should arrive on the ground not later than the

morning after battle, and arrangements to that end must be made by the chief surgeon, who will have received timely notice of an impending engagement from the chief surgeon of the troops about to engage, and who will also indicate the time and place where they will probably be most needed. The personnel of the transport column is also available to act as escort to detachments of sick and wounded sent to the rear in boats or trains, and to establish rest stations along the line of evacuation.

Evacuation hospitals are mobilized at the rate of two for a division. Each of these institutions has a bed capacity for 324 patients and may be divided into three sections. A section of an evacuation hospital includes sufficient personnel and equipment to relieve an established field hospital.

Evacuation hospitals have a more elaborate equipment than field hospitals, including everything required for three such units, transportation excepted; consequently when the latter are taken over by the line of communication organizations, all the materials and supplies in use with patients may be left with them, and the field-hospital equipment completed from the supplies brought by the evacuation hospital.

Enough tentage is provided for the number of patients indicated, but if it becomes necessary that more permanent arrangements be made, pavilions may be constructed according to the plans and specifications now on file in the office of the Surgeon-General. These plans provide for the most simple possible construction from material usually found in any market. However, it would often be practicable to establish these institutions in towns and villages where use may be made of buildings.

Evacuation hospitals are intended for the temporary care and treatment of patients whose condition is such as to require them to be evacuated to the base or further to the rear, and when practicable for the definite treatment of those who may be expected to recover within a short period of time, and for such as cannot stand transportation. They constitute the central point toward which the collecting zone converges and from which the evacuating and distributing zones diverge. They are, therefore,

of the greatest importance as far as the removal of the sick and wounded is concerned. The evacuation hospitals constitute the link between all three zones and are the units which the chief surgeon must employ in establishing and maintaining the flow of sick and wounded between the field hospitals and the railway line of evacuation. In connection with battle service their function is similar to that of field hospitals, which they supplement or relieve.

Field hospitals may be taken over on the ground by evacuation hospital organizations, or the patients may be transported to a conveniently located evacuation hospital, so that the field hospitals may be free to rejoin their units if there is a possibility of another engagement.

More permanent arrangements than are afforded by field hospitals will also have to be made at or near the battle-field for non-transportable wounded, and the chief surgeon must bear that in mind in making his plans for the use of the evacuation hospitals.

As troops advance from the base and the line of communications is extended, evacuation hospitals or sections thereof will have to be established at suitable points along the line, and especially at the advance depot, for the sick of the command. Preference would naturally be given to locations in towns that offered shelter and other conveniences for the care of patients.

It would be unwise to send those requiring only a short period of treatment further back than the evacuation hospitals, if military and climatic conditions permit, as much time would unnecessarily be lost in returning men to their organizations upon recovery, thus materially reducing the effective strength at the front.

An evacuation hospital or a section thereof may have to be established as a hospital for contagious disease, as it is hardly consistent with our ideas of sanitation to attempt to move such cases a long distance from the zone of operations, if proper provision can be made on the line of communications.

Whenever an engagement is imminent, the established hos-

pitals would have to be cleared as far as possible in anticipation of the arrival of large numbers of wounded, and those institutions which are available must be advanced within reach of the battle-field, in case of a successful termination of the engagement, to relieve and supplement field hospitals on the ground. If there is a rail or waterway convenient to the field of operations, these institutions are to be loaded on cars or boats in readiness to be forwarded upon telegraphic notice. One of these institutions would probably be at once established at the rail head or boat-landing to act as receiving hospital for those in process of evacuation.

Ordinarily it would be advisable to begin the evacuation to the rear at once, even in case of victory, as it is quite desirable to clear the zone of operations of wounded as soon as possible. Their presence would not only be an impediment to the movements of the troops, but would also complicate the supply problem of the army. When evacuation hospitals take over field hospitals on the ground, a provisional establishment only would be contemplated and arrangements made for their speedy evacuation.

Should the field of battle be a day's march or more from the rail or waterway, evacuation hospitals should be advanced to the nearest station in anticipation of the engagement. They would then be in readiness to be moved up within reach of the field, so that in case of victory some of them might be established near it in order to relieve field hospitals, so that the latter may rejoin their units in case of an advance or a renewal of the engagement.

It would be the duty of the chief surgeon of the line of communications to provide the necessary transportation for evacuation hospitals that are to be moved over ordinary roads, by drawing upon the trains belonging to the line of communications and Red Cross columns, or by requisition upon the civilian population of the district.

It is believed that the necessity of providing regular transportation for at least one of the evacuation hospitals of each division will at once appear in a great campaign, and provision

should therefore be made in our war organization. This necessity would perhaps be best met by an allowance of motor vehicles. About thirty four-mule wagons would be required to transport the light equipment of one of these hospitals. A considerable reduction in the weight of the material will be accomplished by leaving out the tentage, which would not be needed if the hospital is to be established in a town.

A base hospital with a bed capacity for 500 patients is mobilized for each division, which is to serve as a safer and more permanent institution for the treatment of sick and wounded than evacuation hospitals. Its equipment is much more complete than other hospitals near the front and approaches that of general hospitals.

Base hospitals also constitute a link between the evacuating and distributing zones, and serve to relieve the more temporary institutions of patients, especially of those who will require prolonged treatment, or who are permanently incapacitated. On account of their better equipment, safer location, and proximity to the source of supplies, they are better able to take care of the more serious cases. The definite classification of cases is also carried on in base hospitals, and all requiring prolonged treatment and those incapacitated for further service are, under instructions from the War Department, promptly evacuated and distributed among general hospitals.

The outflow of patients from the line of communications to general hospitals must keep pace with the influx from the institutions in the collecting and evacuating zones, otherwise the service of the base and evacuating hospitals and finally that of the field sanitary units will become clogged. The chief surgeon of the line of communications must therefore not only arrange to meet the demands of the troops at the front, but also by timely and far-sighted representations to the War Department or to the chief surgeon of the army in the field, obtain the necessary means and facilities to initiate the further evacuation of non-effectives to general hospitals.

In anticipation of a large influx of wounded from the battle-

field, special efforts may have to be made to clear base hospitals as well as evacuation hospitals of sick, and a prompt and efficient evacuation service must be provided from the very beginning.

As indicated by their name, base hospitals are usually established near the base of operations, which corresponds to the rear end of the line of communications and marks the beginning of the general line or lines of distribution to and in the home country, the sanitary service of which is directly under the control of the Surgeon-General and the War Department.

Base hospitals are to be established in towns where suitable buildings may be made use of, but in case of necessity pavilion hospitals may be built in accordance with plans and specifications that already have been prepared in the office of the Surgeon-General.

The medical supply service is of such great importance to the sanitary department at the front as to merit exhaustive consideration in a work that professes to treat of the service of the medical department in the field; but in view of the fact that it is so completely covered in the Manual for the Medical Department, little need be said on the subject here.

A supply depot is mobilized for every division which follows its unit into the field. It remains, however, at the base of operations or at some other convenient point on the line of communications where the necessary transportation facilities may be had. When divisions are united to form field armies, the depots may be combined or they may be established at different points as may be called for by the special situation. As the line of communications is extended by the advance of the troops, a depot or a section thereof must be brought up and finally established at the advance depot for the convenience of sanitary organizations serving with troops at the front.

The depots must be prepared to replace the materials used at the front and in the institutions on the line of communications, and to furnish the supplies necessary to improvise additional hospitals, hospital trains or boats, rest stations, convalescent camps, etc., etc.

The personnel, organization, and capacity of hospital trains and boats are laid down in regulations, but thus far no definite steps have been taken to provide hospital cars and boats for use in time of war, and they will have to be improvised when the emergency arises.

Certain supplies and material, including litter supports, necessary to fit up passenger and freight cars are contained in the field supply depots, and boats and trains can be hastily prepared to transport patients. Trains bringing supplies to the front may thus be prepared to return with patients, and systematic arrangements for such service must be made by the chief surgeon.

It must also be noted that hospital provision will have to be made at every post or station established along the line of communication, not only for the reception of the sick of the garrison of the place, but also for such as may be left behind by troops passing through on their way to the front. Such improvised hospitals may become of great importance if near enough to the battle-field to be reached by wounded *en route* to the regular evacuation line.

Nothing definite can be laid down concerning the organization, equipment, and service of those institutions mentioned in regulations for which no definite personnel is provided. Their organization and equipment constitute an important problem for the chief surgeon, which will have to be worked out at the time and place. They are important because of the relation to the evacuation service. The personnel and supplies of Red Cross organizations will probably have to be largely relied upon for service at such stations.

Red Cross Columns.—All military nations have apparently come to the conclusion that it is impracticable to organize an army medical department of sufficient magnitude to give the necessary care and attention to the sick and wounded in time of war, and that they must rely largely upon voluntary aid offered by patriotic citizens. While the service of individuals not trained in military organization is notoriously less efficient and more expensive than that of disciplined military personnel, yet patri-

otic citizens must be given an opportunity to lend their assistance in time of national peril. It is to be presumed, however, that only such individuals will be enrolled in the Red Cross organizations as are disqualified for commission or enlistment in the army by reason of age, sex, or physical infirmity. Regulations provide, however, that "no one will be so employed who is physically or otherwise disqualified for effective service." For service in war, Red Cross personnel is organized into columns and legions which conform, in a measure, to the smaller sanitary units of the army, and are trained for the special duties that will be required of them. A Red Cross delegate or director general will supervise the Red Cross service, under the direction of the chief surgeon, at the base and line of communications. It is distinctly understood that Red Cross organizations shall not establish separate, independent institutions on the line of communications but will be attached to, or serve under commanding officers of army medical department units.

For service at the base and on the line of communications Red Cross personnel is organized into units as follows:

1. Field columns.
2. Hospital columns.
3. Supply columns.
4. Information bureau sections.

Field columns correspond to "Transport columns" of the army and are composed of physicians, pharmacists, nurses, litter bearers, disinfectors, drivers and laborers, with such wheeled transportation as may be required. Field columns will assist the regular transport columns in evacuating field hospitals; furnish personnel and material for trains and boats for patients and rest stations; transfer patients to and from trains and boats, and perform other duties that devolve upon transport columns.

Hospital columns correspond to sections of evacuation hospitals or to field hospitals and are composed of physicians, pharmacists, dentists, nurses, cooks, litter bearers, disinfectors

and laborers, with such hospital matériel as may be deemed necessary.

Hospital columns do not establish independent institutions but are used to supplement and assist regular hospital organizations by taking over wards, kitchens, laundries, etc. Only in case of great emergency will hospital columns be called upon to assist regular field hospitals in the zone of operations.

Supply columns are composed of pharmacists, merchants, clerks and laborers, and have charge of the storage and distribution of Red Cross supplies.

Information bureau sections are organized for the purpose of keeping relatives and friends advised of the location and condition of sick and wounded.

ADDENDUM.

The general principles of sanitary tactics as set forth in the preceding pages are ably illustrated by a series of problems contained in "A Study in Troop Leading and Management of the Sanitary Service in War," by Major (now Lieutenant-Colonel) John F. Morrison, General Staff, and Major Edward L. Munson, Medical Corps, and in "The Principles of Sanitary Tactics," by Major Edward L. Munson, Medical Corps. The series of problems contained in the above-mentioned works form a progressive course of instruction and include examples of the more important sanitary situations which officers may be liable to be called upon to meet. These problems will be found to be most interesting and instructive, especially by those familiar with the regulations bearing upon the subject and the general principles of sanitary tactics.

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